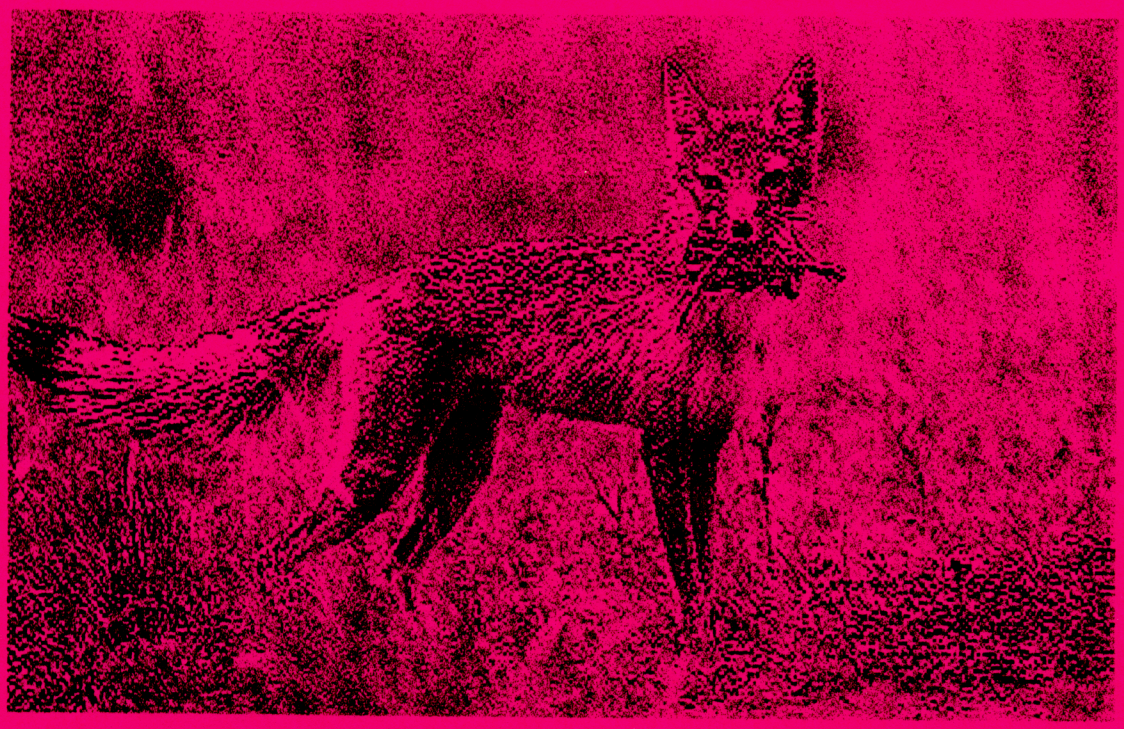
1998 Swift Fox Conservation Team Annual Report



Edited by:

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Kansas Department of Wildlife and Parks

May 10, 1999

Overview

Roy, Christiane, C., ed. 1999. 1998 Swift Fox Conservation Strategy Annual Report

Since 1994, State Agency representatives to the Swift fox Conservation Team (Team) have met annually to report on their respective state swift fox management and research activities. The information acquired by state agencies have been compiled annually to provide ongoing species status information, and the Team's progress in achieving goals and objectives set forth in the Conservation Assessment and Conservation Strategy for the Swift Fox in the United States.

Several new activities took place during 1998. Following 3 years of intense monitoring of swift fox distribution by the Team, the Fish and Wildlife Service (FWS) has received sufficient new evidence that swift fox populations throughout their range do not warrant listing (Team/FWS conference call April 30, 1998). Representatives of the FWS Ecological Service's office in Pierre, SD have initiated the process for removing the swift fox from it's warranted but precluded status. This process is not subject to any time line and may take a year or more to be completed.

The first International Swift fox Symposium was held in Saskatchewan, Canada in February 1998. A peer reviewed publication of the symposium presentations will be available in 1999. This document is the first of its kind to assemble the most recent research findings and management activities on swift fox and will provide a valuable reference for swift fox managers.

The team is currently not involved in operational programs to create new swift fox populations from reintroduction efforts. This aspect of swift fox conservation has been reviewed(see 1998 meeting minutes). The team urges caution in planning this activity to avoid future genetic fitness problems. A new reintroduction project was undertaken by the Blackfeet Indian Reservation and Defenders of Wildlife on Tribal land in northern Montana. A total of 30 swift foxes from the Cochrane Institute, Canada, were released during the summer of 1998. The Team was not involved with this reintroduction effort and does not support reintroduction of swift fox at this time.

A summary of the completion status of Conservation Strategy objectives as well as other relevant issues applicable to the Conservation Strategy follows. Three states (Kansas, Montana, and Texas) and both Canadian provinces (Alberta and Saskatchewan) have established state/provincial swift fox working groups (obj. 1.1.3). Other states are not likely to develop state working group in the near future, however, short grass ecosystem working groups may be developed to address multiple species concerns.

Swift fox distribution (obj, 2.1.1 and 2.1.2) has been completed in Kansas, New Mexico, Wyoming, and Colorado. Additionally, South Dakota and Montana have completed 25% of their potential swift fox range, and Oklahoma has completed 50% of their potential range. Nebraska will be initiating a statewide independent survey in the near future.

Short grass prairie habitat mapping (obj. 5.1.1) has been completed in Oklahoma, Montana, the Buffalo Gap National Grassland in South Dakota, and Wyoming. Kansas has completed 50% of the mapping . Other states have not yet initiated this objective. Habitat delineation for swift fox (obj. 5.2.1) based on vegetative community associations have been controversial. Community associations may have limited geographical relevance for swift fox since there is no evidence that they are dependent upon shortgrass prairie to survive. However Texas, New Mexico, Oklahoma, Montana, and the Buffalo Gap National-Grassland have all initiated habitat delineation work.

All state representatives, except North Dakota and Kansas, are involved with the management of other species in need of conservation (obj 8). These include species such as the black-tailed prairie dogs, burrowing owl, mountain plover, and black-footed ferret. The need for a more global approach involving the management of multiple species dependent upon short grass prairie ecosystem has been raised many times.

Several products have been developed to promote public support for swift fox conservation (obj 9.2). Our first annual newsletter was published and distributed to landowners in several states. An educational video on short grass prairie was developed by Kansas and will be available before the end of 1999 for distribution. The American Zoological Association Canid Technical Advisory Group has been actively involved in developing a swift fox education program (Appendix II).

Finally states involved in research projects during 1998 (obj 10) included Texas, Colorado, New Mexico, and the USGS Northern Prairie Wildlife Research Center. States that have collected blood samples from current or past research projects for a disease or DNA databases include Colorado, Kansas, New Mexico, Texas, Nebraska, and Wyoming. Blood samples are also available from South Dakota.

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Swift Fox Investigations in Colorado in 1998

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ABSTRACT

Swift fox (*Vulpes velox*) has been documented to occupy most the remaining short grass prairie in eastern Colorado (Kahn et. al 96). There existed a gap in the survey and analysis of agricultural lands in eastern Colorado. Fitzgerald recommended that these eastern agricultural counties be surveyed for habitat use by swift fox. It was surmised that those counties could have swift fox in them after they were found in agricultural lands in neighboring Kansas (Fox and Roy 1995, Roy 1996).

Trackers hired to conduct the track surveys in Kansas were asked to search 12 townships in three eastern Colorado counties including Kiowa, Kit Carson and Yuma. Swift fox were found in all three counties. Expenses were paid by Section Six funds and the Kansas Department of Wildlife and Parks Colorado provided maps for the project.

Eric Geese of Utah State University continued investigations in Colorado at the Pinyon Canyon Site in South Eastern Colorado. During this year study he radio collared 37 (20 males and 17 females) new foxes during 1998.

INTRODUCTION

The Conservation Assessment and Conservation Strategy for Swift Fox in the United States (Kahn et.al 1996) identifies historic, current and potential swift fox distribution in Colorado (Figure C6) this map indicates that five counties Segwick, Phillips, Yuma, Kit Carson and Kiowa had potential swift fox habitat but that the presence of the species could not be documented through current surveys. Dr Eric Gese continued studies with Graduate students studying the interrelationships between coyotes and swift fox. A

master's thesis is expected to be finished in 1999 and will be made available to all members of SFCT when completed.

METHODS

Three counties (Yuma, Kit Carson and Kiowa) in eastern Colorado were surveyed to determine presence or absence of swift fox. Alternate townships near the Kansas border were surveyed in late August 1998 by two experienced trackers also involved in the Kansas track survey. This period coincides with the time when swift fox detection rates are the highest (Sovada and Roy 1996). Experienced trappers were used that had previous experience in reading swift fox tracks in Kansas. Trackers were provided with detailed county maps and a listing of the most appropriate road to survey based on surrounding habitat. Emphasis was placed on searching secondary roads, low maintenance roads, section lines and areas where tracks could be observed without requiring private land access. Townships were searched for a minimum of 30 minutes. For all furbearer tracks encountered, the species was identified, soil tracking conditions, habitat surveyed and the time needed to find a track. If no evidence of swift fox occupancy was detected during the first 30 minutes, the search continued either until swift foxes were detected or for a maximum of 120 minutes. When a swift fox track was identified, a photographic record was taken of one of several tracks with measurements of the track's length and width.

RESULTS

Of the 12 townships surveyed swift foxes were detected in 8 (66%) including one in all three of the counties surveyed. 50%of the fox were detected in fallow farm ground with the rest distributed in CRP ground, winter wheat, and range lands. Other species detected by the survey were coyotes (*Canis latrans*), cottontails (*Sylvilagus floridanus*) or jackrabbits (*Lepus sp.*), skunks (*Mephitits mephitis*), badgers (*Taxidea taxus*) racoons (*Procyon lotor*), and domestic dogs (*C. familiaris*).

DISCUSSION

The survey has indicated that swift fox are present in those counties and townships of eastern Colorado that have less than 25% short grass prairie. These detection's confirm that swift fox are found throughout eastern Colorado. Including those counties that are predominantly agricultural lands. Updated maps should indicate that these three counties have swift fox present. This would leave Phillips and Segwick counties along the eastern border with other plains states that has not been surveyed. We intend to survey these two counties during the summer of 1999.

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An Improved Method for Determining the Distribution of Swift Foxes in Kansas

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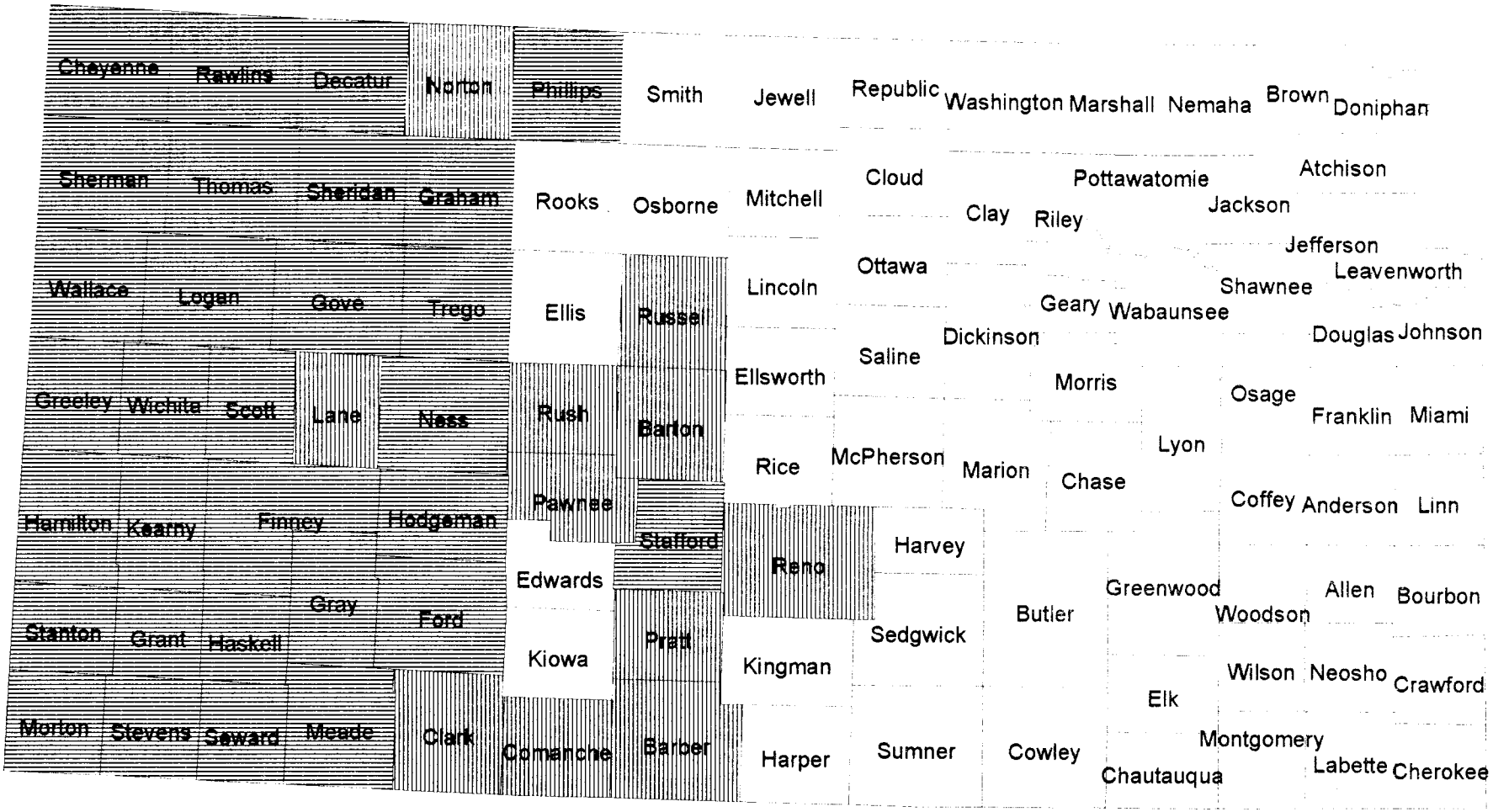
Abstract

During 1997 and 1998 we tested a new method for determining the distribution of swift foxes (*Vulpes velox*) in Kansas. From a sampling frame of 30 counties in western Kansas, we selected a systematic sample of alternate townships in a checkerboard pattern. During September and October 1997 and August 1998, experienced observers delineated suitable swift fox habitat within each sample township and searched it for evidence of occupancy (tracks, dens, and the animals themselves) by swift fox and other furbearers. Each township was searched for a minimum of 30 minutes, with searches continuing until swift foxes were either detected or for 120 minutes. Of the 288 townships selected in 1997, 271 (94.1%) were searched effectively with swift fox detected in 40.5% of the townships. Adverse weather conditions prevented surveys in two northwestern counties of our sample frame. In 1998, 245 township were searched effectively. Swift fox were detected in an additional 26.1% of the townships that had resulted in no detection in 1997 or had not previously been searched. Swift fox have now been detected in 27 counties searched to date . We did not detect swift fox in Seward, Meade and Ford counties, where the species is thought to be uncommon or absent. Tracks were difficult to discern in areas with hard or sandy soils and were sometimes obliterated by adverse weather, vehicle traffic, and agricultural activities. To determine how frequently we failed to detect swift foxes that were present, we plan to repeat searches in 1999 in townships where swift foxes were not detected previously. Nevertheless, preliminary results suggest our method to be a practical means for conducting landscape-scale presence/absence surveys of swift fox. Restricting searches to habitat judged best for swift foxes and most favorable for track detection helped control costs and achieve high detection rates.

Introduction

Swift fox populations in Kansas have greatly fluctuated since pre-settlement. Based on reports of settlers, it appears swift fox occurred in 41 counties in Kansas at the time of settlement (Figure 1) (Carter 1939, Zumbaugh and Choate 1985). In the late 1800's and early 1900's, swift fox numbers declined and became increasingly rare (Knox 1875, Baker 1889, Lantz 1905) and by the 1930's it was believed that they had been extirpated from Kansas (Black 1937, Cockrum 1952). It was not until the early 50's when the swift fox in Kansas started its slow but steady comeback, and specimens were being collected (Martin and Sternberg 1955, Hibbard and Taylor 1960, Anderson and Fleharty 1964, Janes and Gier 1966, Boggess and Johnson 1981, Zumbaugh and Choate 1985, Walker 1987). By 1980 the population was recovering. Boggess and Johnson (1981) considered the swift fox population in Kansas to be stable and even expanding through much of the historical range. Their reports indicated that 100-400 swift foxes were incidentally taken each year in traps set for coyotes (*Canis latrans*). During the 1982-83 season, Zumbaugh and Choate (1985) collected 215 specimens from 12 different counties and concluded the swift fox had reoccupied much of its original range in Kansas.



Swift Fox Historical Distribution - Documented Records ((Zumbaugh andChoate 1985)
Additional Swift Fox Historical Distribution - Undocumented records (Carter1939)

Figure 1. Historical Swift Fox Distribution

Swift Fox Management in Kansas

Swift fox harvest was re-authorized in 1982 under a limited furbearer harvest season. In 1994, the Kansas Department of Wildlife and Parks (KDWP) adopted a swift fox pelt-tagging program aimed at monitoring harvest and providing additional information on the current distribution of swift fox in Kansas. Locations of harvest, number harvested, methods of take, primary target species, and types of habitat utilized by swift foxes were recorded. With low pelt prices and few furharvesters located in the shortgrass prairie, less then 50 foxes have been tagged annually providing limited information. Other methods used to monitor swift fox populations include the annual roadside survey of wildlife. Locations and number of live or dead swift fox are recorded annually during the fall. Limited roads and a low number of employees prevents a sufficient coverage and results in low observations of swift foxes. The lack of sightings is often interpreted as inadequate swift fox populations whereas numerous vehicle killed foxes are interpreted to indicate the adverse influence of roads on swift fox populations (D. Allardyce, pers. comm.). Roadside surveys of swift fox have provided opportunistic observations by some individuals but have not offered a systematic or a random search of a specific area. Two of the primary objectives of the Swift Fox Conservation Team was to determine the best tool to monitor swift fox populations and implement statewide surveys throughout the swift fox's historical range (Swift fox Conservation Strategy, 1995). The development and implementation of a strategy to monitor swift fox distribution and population trends is needed.

In 1996, a preliminary study on the usefulness and precision of five survey methods to estimate the distribution and abundance of swift foxes was conducted (Sovada and Roy 1996). Survey methods evaluated included: spotlight survey, track search on both line transects and within quarter-sections (Sargeant *et al.* 1993), scent-station survey (Linhart and Knowlton 1975), and scat-deposition rate survey. Each survey tested successfully detected swift fox. However, rate of detection, time to run the survey, and cost expenditure varied greatly. Preliminary results suggested that furbearer track search along roads provided the most reliable and practical mean of detecting swift fox (Sovada and Roy, 1996). Furthermore, track searches along roads do not require any landowner permission. Our objectives are to evaluate the effectiveness of a systematic track search on a large scale area and determine the distribution of swift fox throughout western Kansas over a three year period.

Special thanks go to L. B. Fox, C. D. Lee, and J. Stephens for their valuable comments on the survey design and revisions. We thank Charles Lee, all trackers, and KDWP district biologists who provided valuable time to conduct the surveys. This research was funded by the Endangered Species Act Section 6 funding and the Kansas Department of Wildlife and Parks.

Methods

Most track surveys used to monitor furbearers require the use of specific transects repeatedly surveyed through time. Changes in landscape use however, make the use of fix transect line potentially inadequate to locate and monitor furbearer populations trends or distribution. We therefore selected to survey entire townships and limit the time allowed to complete each search. The use of townships as survey blocks, as opposed to predetermine transects, allowed us to restrict and adapt our search areas to habitat judged best for swift foxes and most favorable for

track detection. For each county surveyed, we used a systematic sample of alternate townships in a checkerboard pattern. Surveys conducted in 1996 included 288 townships across 24 counties. We limited our search in 1997 to 245 townships where no swift fox were detected the previous year and to unsurveyed areas. Surveys conducted in 1999 will also be limited to those areas where no swift fox were previously detected or where detections where questionable and will include counties in Nebraska and Colorado.

In 1997, surveys were conducted during September and October. This period coincides with the time when swift fox detection rates are the highest (Sovada and Roy 1996), however, this period also coincides with the greatest amount of road disturbance associated with the fall harvest, making track detection more difficult. In 1998, surveys were conducted in August to improve tracking conditions while still providing adequate detection rates.

Trackers were initially required to bid on the blocks they wished to cover and the overall costs of performing the surveys. In both years we selected four individuals based on their experience at reading tracks and familiarity with the areas to survey. Block allocation ranged from 20 to 80 township per individual. Three of the four trackers used in 1997 participated again in 1998. Additionally, two district biologists from the Kansas Department of Wildlife and Parks participated and searched one county each in 1998. All trackers were required to attend a one day training session to familiarize themselves with the data recording requirements and to ensure proper identification skills of furbearer tracks. Trackers were provided detailed county maps and a listing of the most appropriate roads to survey based on surrounding habitat. Emphasis was placed on searching secondary roads, low maintenance roads, section lines, and areas where tracks could be observed without requiring private land access. Public land in Kansas is scarce and having to request permission to access private properties would be unfeasible. Allen (1996) found no differences in furbearer track detection rates between searches on roads and within quarter sections, making searches along roads less time consuming and more efficient. Other requirements of the survey included waiting at least 24 hours after a rainstorm or not conducting searches during extremely windy days.

Townships were searched for a minimum of 30 minutes. For each township surveyed, the availability of tracking sites and the distance and specific road driven were recorded . For all furbearer tracks encountered, species were identified, and an evaluation of the soil tracking conditions, surrounding habitat type, and the time needed to find a track was noted. If no evidence of swift fox occupancy was detected during the first 30 minutes, the search continued either until swift foxes were detected or for a maximum of 120 minutes. When a swift fox track was identified, a photographic record was taken of one or several tracks with an indication of the track's length. In 1998, we also required specific measurements of track length and width. If a dead fox was encountered (usually due to a vehicle accident), a photographic record was taken and a lower canine was extracted for future identification and aging. Trackers were also required to maintain a log of live or roadkill swift fox locations observed outside the survey areas. To insure that each tracker had adequate tracking skills, a sub-sample of 10 townships within each of the trackers search area were selected and re-searched by a district biologist or a wildlife damage control specialist from KDWP.

Results

The use of a bidding system to enlist trackers was reasonably successful. Finding qualified individuals familiar with the area to survey and available during the survey period was, however, challenging. In 1997, twelve individuals responded to the bid process from which four were selected. In 1998, 5 individuals responded to the bid and four were also selected. Bids ranged from $25.00 to $125.00 per township with an average final remuneration of $70 per township. Trackers drove an average of 23 miles per township and 250 miles per day. Each tracker completed the survey in an average of 14 days. Only one individual performed poorly in 1997, and could not detect the presence of swift fox in several townships where previous surveys had indicated swift fox were present (Fox and Roy 1995, Sovada and Roy 1996, Sovada et al. 1998). This individual's townships were re-surveyed by the two most experience trackers. Their results were used in the analysis. In 1998, one of the trackers was not hired due to his poor tracking skills determined during the training session.

In 1997, the tracker with the northern most townships could not complete all his surveys due to adverse weather conditions in late October. Of the 288 townships selected to survey in 1997, 271 (94.1%) were searched effectively. Swift foxes were detected in 40.5% of townships surveyed, including 16 of the 23 counties selected (Figure 2). No swift fox tracks could be detected in Haskell county, however, two vehicle killed swift foxes were observed as the tracker was moving from one township to the next. A KDWP employee also reported sighting a vehicle killed swift fox in Stevens County where no tracks were detected. In 1998, 245 townships were selected and all (100%) were searched effectively. Swift fox were detected in an additional 26.1% of the townships that had resulted in no detection in 1997 or had not previously been searched (Figure 2). This included detection in a an additional 11 counties. Swift fox were found to be present in 27 of the 30 counties searched to date. No swift fox have been reported in Seward, Meade, and Ford counties.

For each township where we successfully detected swift foxes, tracks were detected up to four times per township during the initial 30 minute search period in 1997 and up to three times in 1998 (Figure 3). Detection rates ranged from 1 min. to a maximum of 126 min. We assume that the time necessary to detect swift fox is inversely related to the abundance of the species in an area where availability of track sites and environmental conditions are similar. In 1997, trackers invested less then 60 min. to detect swift fox tracks 91% of the time (Figure 4). In 1998, trackers invested 100 minutes to detect swift fox tracks 90% of the time (Figure 4). No significant differences were detected between trackers in the time required to detect a swift fox track successfully (1997: P=0.07; 1998: P=0.075). However, 1997 trackers in the northern and southern part of the state spent significantly more time searching townships ($P< 0.01$) and finding significantly less track series ($P< 0.01$). In 1997, availability of sites to detect furbearer tracks were moderate (45.6%) to excellent (26%) and in 1998 site availability were moderate (51%) (Table 1). Soil tracking conditions are presented in Table 2. Wind conditions during the survey were generally less then 15mph (Table 3).

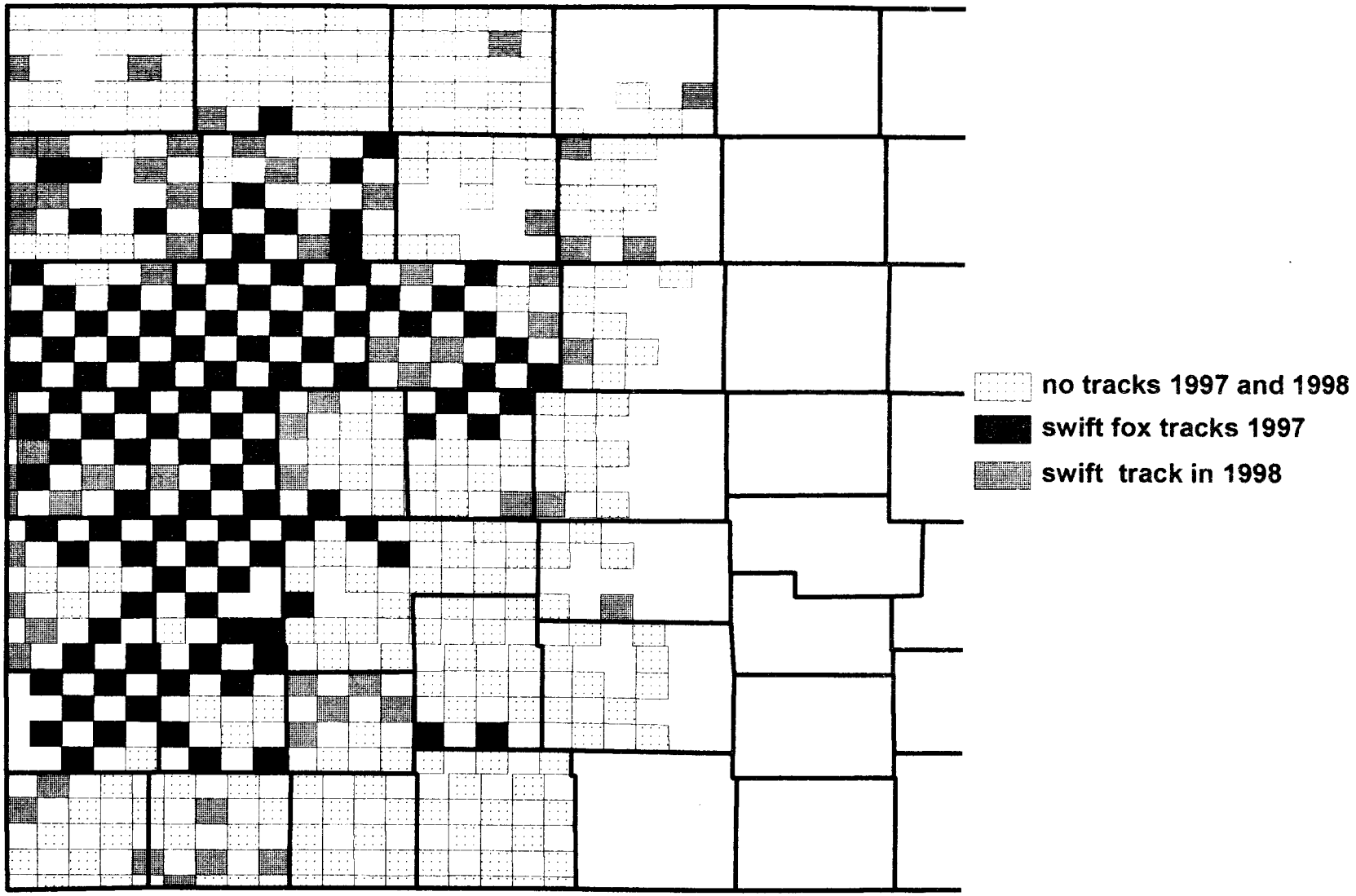
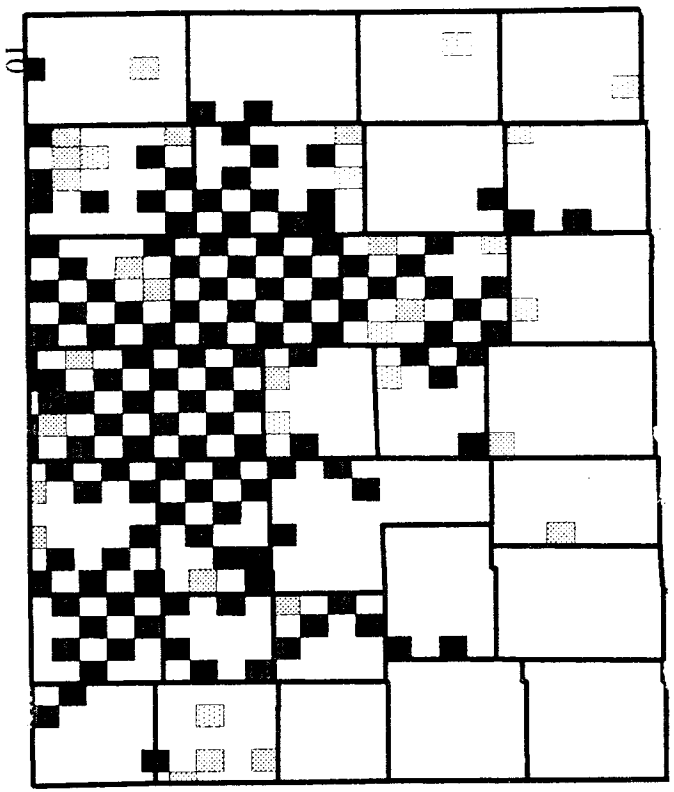
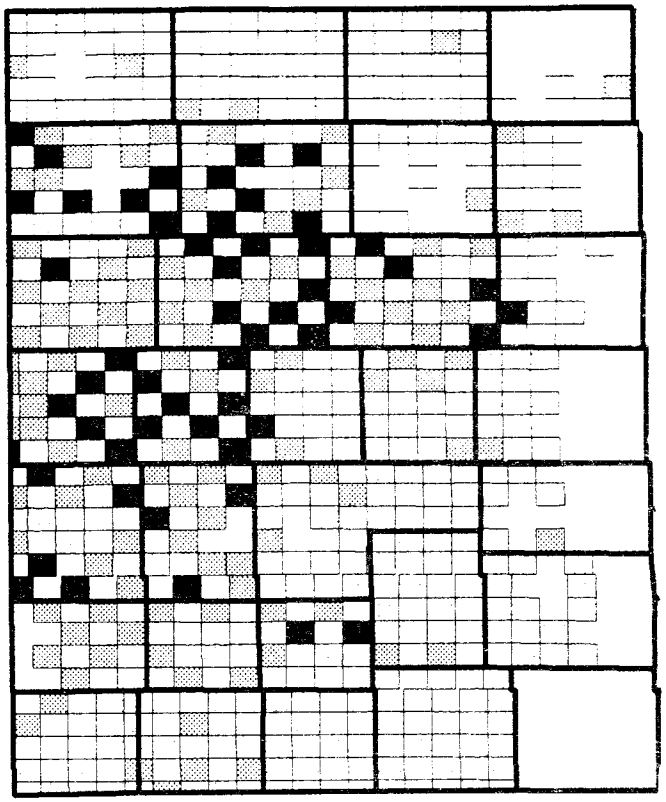


Figure 2. Townships where swift fox tracks were detected during the 1997 and the 1998 swift fox survey in Kansas





less then 30 minutes
30 - 60 minutes
60 - 90 minutes
more then 90 minutes

three or more track series detected
two track series detected
one track series detected
no track series detected

Figure 3. Time to detect a swift fox track and number of track series detected in a township during the 1997 and 1998 swift fox surveys in Kansas.

Table 1. Frequency of site available to detect furbearer tracks during the 1997 and 1998 swift fox track survey

Availability of Sites	1997	1998
Almost none (gravel/pavement/urban areas)	5.4	2.5
Few	23.6	21.8
Moderate	44.8	53.9
Many (secondary roads, unmaintained roads)	28.3	21.4

Table 2. Frequency of soil tracking conditions to detect furbearer tracks during the 1997 and 1998 swift fox track survey

Soil Tracking Condition	1997	1998
Hard dry soil, tracks not visible	4.5	4.8
Sandy soil, tracks hard to distinguish	11.8	17.7
Lightly dusty soil, fair tracking	33.6	30.6
Muddy or wet soil, Good to excellent tracking	49.1	38.7
Dry loose soil, Good tracking	0.9	8.1

Table 3. Frequency of wind conditions during the 1998 swift fox track survey

Wind condition	1998
Almost none (<1mph)	13.1
Mild wind (2-5 mph)	31.4
Moderate wind (5-15 mph)	49.4
Strong winds (15 + mph)	5.7

The average width and length of swift fox track was 28.9mm and 38.4 mm . Only a few tracks were mistakenly reported as swift fox tracks and were in fact young coyote tracks based on the size of the tracks and the photographs provided. These were removed from the analysis.

In both year, swift fox tracks were detected near fallow wheat fields or winter wheat, and only occasionally detected near rangeland or land enrolled in a Conservation Reserve Program (CRP) (Figure 5). The type of habitat where other furbearer tracks were encountered had similar proportions as those presented in Figure 5. Furbearer detected include, coyote, cottontail

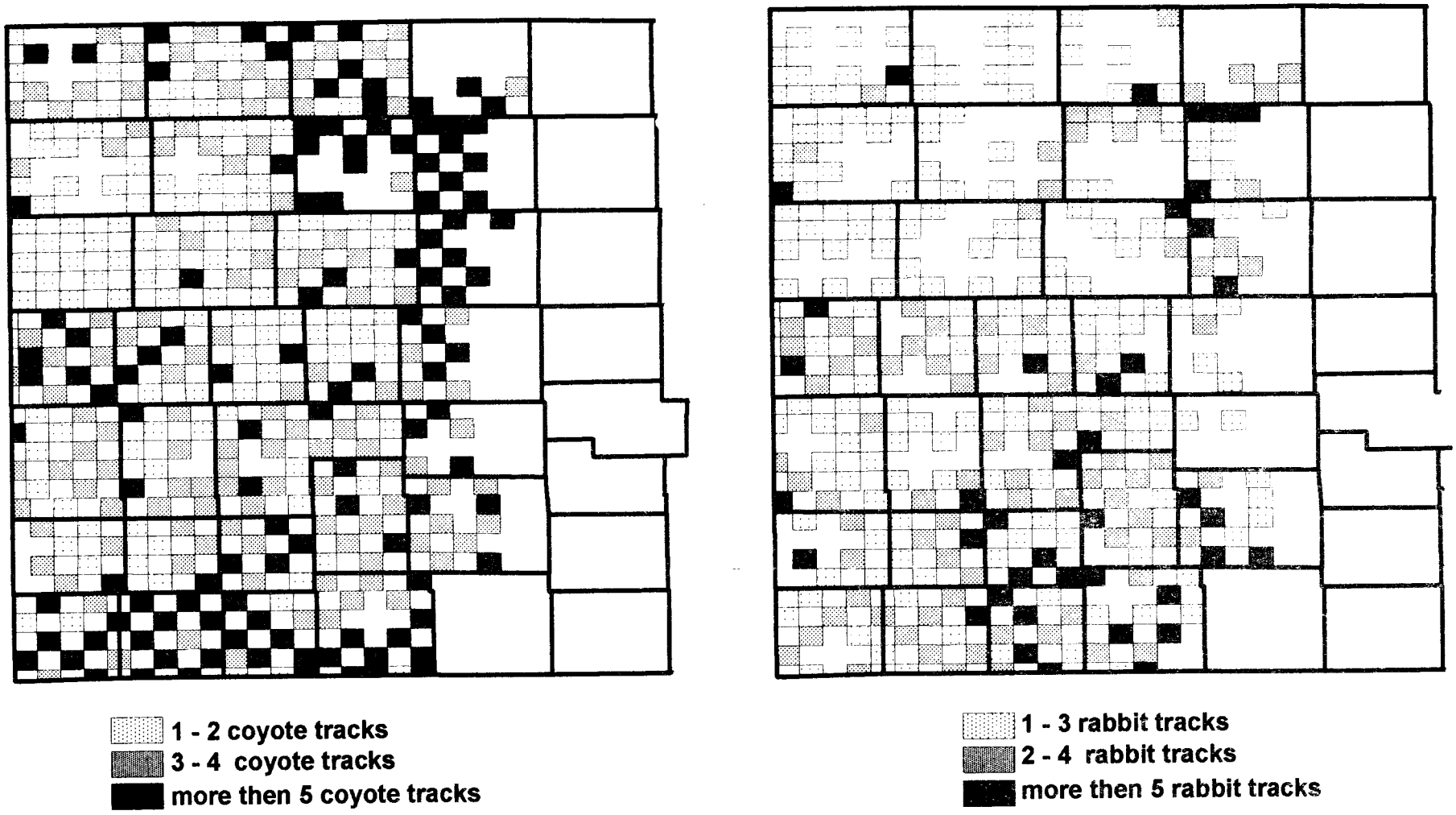


Figure 6. Number of coyote and rabbit (cottontail and jackrabbit) track series detected within a township during the 1997 and 1998 swift fox surveys in Kansas

(*Sylvilagus floridanus*) or jackrabbit (*Lepus* sp.), skunk (*Mephitis mephitis*), badger (*taxidea taxus*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), mink (*Mustela vison*), bobcat (*Felis rufus*), and domestic dog and cat. Coyote and rabbit tracks distribution for 1997 and 1998 are shown in Figure 6.

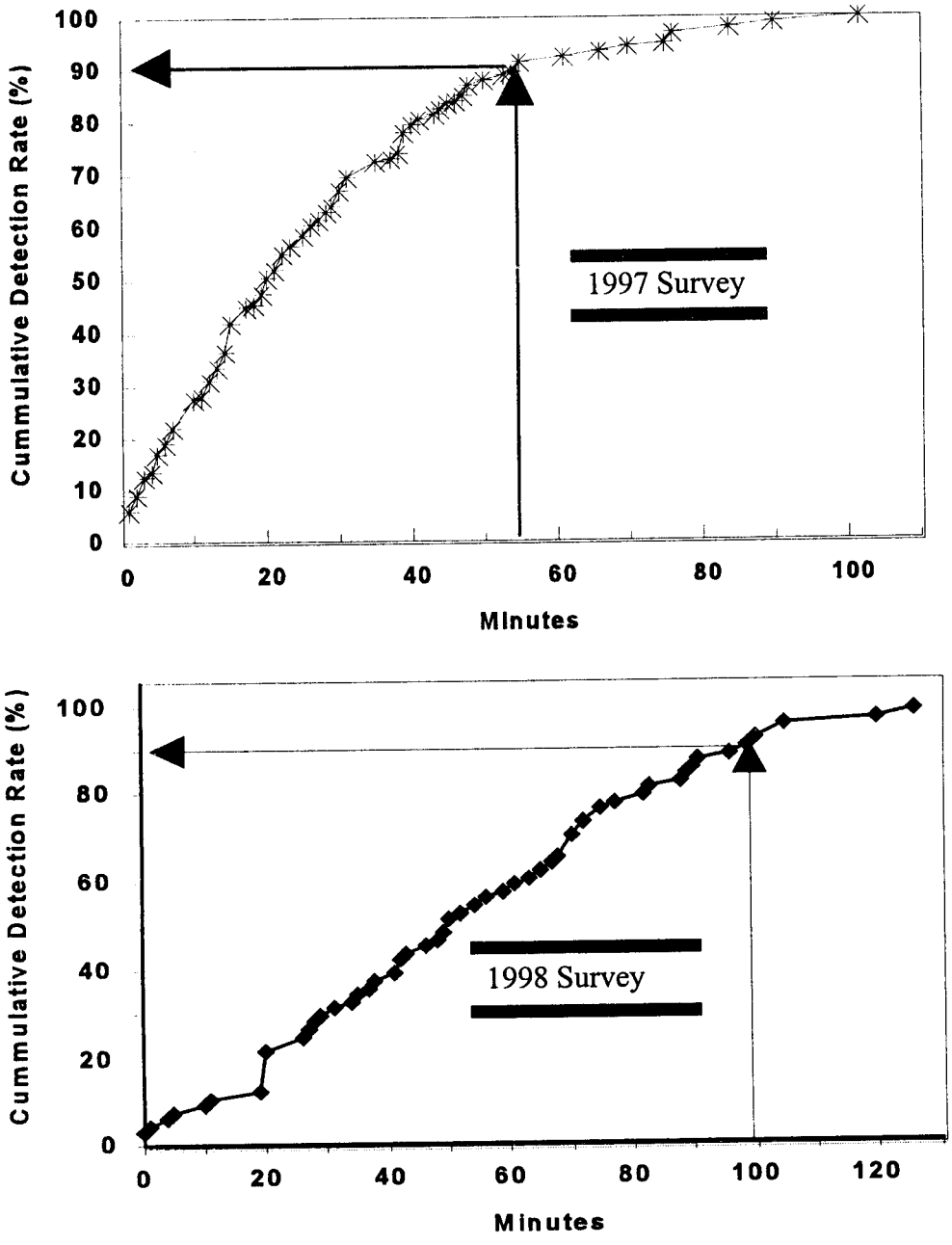


Figure 4. Cumulative detection rate of swift fox tracks during the 1997 and the 1998 swift fox track survey in Kansas.

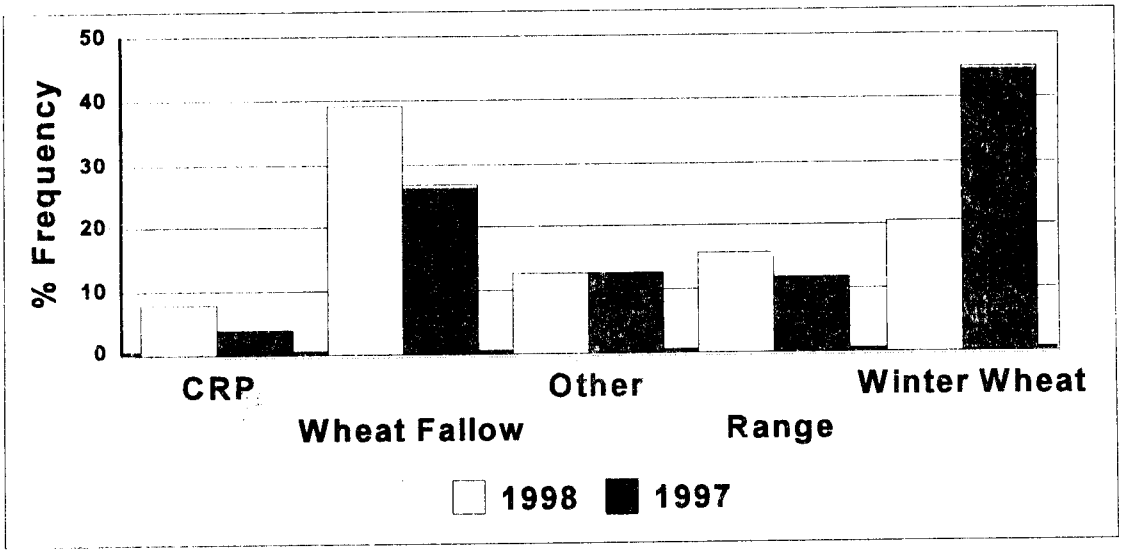


Figure 5. Habitat associated with presence of swift fox tracks in 1997 and 1998.

Conclusion

Preliminary results suggest our method is a practical means for conducting landscape-scale presence/absence surveys of swift fox. In 1997, we surveyed 26, 853 km^2 at a total cost of $9,700. In 1998, we surveyed 22,570 km^2 at a total cost of $7,600. When compared with previous surveys conducted by the KDWP, swift foxes were detected in 14 additional counties (Sheridan, Lane, Stanton, Grant, Haskell, Rawlins, Morton, Stevens, Cheyenne Decatur, Norton, Graham, Trego, and Gray) (Roy 1996). Surveys conducted during the fall crop harvest period in 1997 substantially affected our ability to detect furbearer tracks due to the increased road activity associated with harvest.

Although tracking conditions did not seem to be improved in 1998 based on the soil condition and track availability data acquired, trackers found the conditions to be better in August then in the fall. Longer daylight hours in August also provided more time to search for tracks. Both years, wind speed typically increased in the afternoon and affected the trackers ability to find tracks or to positively identify them. We would recommend continuing to conduct surveys in August or before the crop harvest season, and preferably limit the survey time to mornings. To determine how frequently we failed to detect swift foxes that were present, we plan to repeat searches in 1999 in townships where swift foxes were not detected in 1997 and in 1998 and add additional peripheral areas in Nebraska and Colorado. Restricting searches to habitat judged best for swift foxes and most favorable for track detection helped control costs and achieve high detection rates in most areas.

Both years, swift fox tracks were encountered closer to cropland habitats then rangeland, however, large expenses of rangelands are not readily accessible to the trackers without private landowner authorization. The restriction of searches to roads may limit our ability to detect swift foxes in rangeland habitats. Past research has demonstrated that swift fox successfully utilize rangeland and cropland habitats and are not restricted to utilizing only shortgrass prairie habitats to survive as is generally believed (Kilgore 1969, Hines 1980, Fox and Roy 1995, Sovada and Roy 1996, Sovada et al. in press.).

The minimum search period of 30 minutes allowed us to acquire additional information on other furbearers, helped us determine the ability of trackers to identify furbearer tracks, and allowed trackers to quantify the adequacy of tracking conditions available. Although our survey design cannot be used to determine relative furbearer density, our ability to determine the distribution of coyotes, jackrabbits or cottontail, and other furbearers may help explain some of the current swift fox distribution. Optimal time to invest in a township search varied depending on swift fox population densities. In 1997, trackers searched areas where swift fox were considered common. In 1998 however, townships searched were mostly in areas where swift fox are considered uncommon, rare, or not present. As we expended our search in 1998 to areas where swift fox are less common, the time to detect a track increased. We suggest maintaining the 120 minute search time to allow detection of swift fox in marginal areas of their range. By limiting our time to survey a township we can provide a greater coverage of swift fox range in relatively less time.

Previous surveys used to determine the distribution of swift fox provided sightings only in counties where swift fox were relatively common. For the past 15 years, there has been limited documented sightings in areas where swift fox are less common. Track surveys are now more commonly used in many state agencies to monitor furbearer population distribution and abundance. Surveys are usually ran in the winter months when snow cover is present and detection is greater. Most furbearer biologists however use road transects as opposed to the type of design we used. We hope that information acquired in 1999, will help us better determine the adequacy of this survey methodology to detect furbearer tracks.

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SWIFT FOX MANAGEMENT ACTIVITIES IN MONTANA

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ABSTRACT

During 1998, there were three major swift fox (*Vulpes velox*) conservation/management activities underway or in development which relate to Montana's commitment to the national Swift Fox Conservation Team (SFCT) conservation strategy objectives (Kahn et al. 1997). Fish, Wildlife and Parks (FWP) sponsored the first annual meeting of the Montana Swift Fox Working Group which represents state, federal, tribal wildlife managers and private organizations interested in swift fox restoration and habitat conservation in the state. The Blackfeet Nation cooperated with private organizations in the reintroduction of 30 captive-raised foxes onto tribal land. FWP has committed to funding a statewide species distribution survey for swift fox in 1999. In addition, the Canadian Swift Fox Recovery Team is apparently investigating the feasibility of determining a density estimate of the northcentral Montana population which is adjacent to the Canadian swift fox population.

INTRODUCTION

Information describing historical status and the recent recolonization of swift fox in Montana is provided in Giddings and Knowles (1995), Giddings and Zimmerman (1996), and Zimmerman and Giddings (1997). FWP and Montana State University (MSU) completed a 2-year swift fox research project in northcentral Montana during 1998 which documented an established resident population in the state (Fig. 1). This telemetry study investigated swift fox home range size, movements, habitat use and documented reproducing pairs by locating natal den sites (Zimmerman 1998).

The swift fox remains classified as a state furbearer, providing protection from take through a closed harvest season. Previous statewide habitat assessments have identified approximately 8,000,000 acres of suitable swift fox habitat in Montana (Fig. 1).

To address the swift fox conservation strategy objectives as outlined in the Conservation Assessment and Conservation Strategy of Swift Fox in the United States (Kahn et al. 1997) FWP has completed swift fox habitat surveys in central and eastern Montana (Giddings and Knowles 1996) (Obj. 5) and completed initial swift fox research to assist in determining status and delineating distribution of the species with in the state (Zimmerman and Giddings 1997) (Obj. 2) in addition to investigating swift fox biology and ecology (Obj. 10). Montana remains an active member of the SFCT (Obj. 1) and in 1998 formed a state swift fox working group (Obj. 1) which will provide an avenue to accomplish Obj. 6, 7, 8, and 9 in the state of Montana.

METHODS

Appropriate individuals representing state and federal wildlife/land management agencies and

private organizations that would be able to contribute toward swift fox management were invited by FWP to participate in the Montana Swift Fox Working Group. The first annual meeting was held in northcentral Montana at Chinook during the month of June, 1998. The Blackfeet Nation provided tribal ranch land for a swift fox reintroduction effort in August, 1998 in cooperating with Defenders of Wildlife and the Cochrane Ecological Institute, a captive-breeding facility in Canada. Also during 1998, the state furbearer program requested FWP to allocate funding to conduct a statewide species distribution survey of swift fox.

RESULTS

The Montana Swift Fox Working Group has been organized and is active. Participants include representatives from FWP, Montana Natural Heritage Program, MSU, US Fish and Wildlife Service, USDA/APHIS Wildlife Services, Bureau of Land Management, Blackfeet Tribe Fish and Wildlife, Fort Belknap Reservation, Defenders of Wildlife, Predator Project, and FaunaWest Wildlife Consultants. The group's function is to compile ongoing state status information in an effort to provide information and management recommendations to state and federal wildlife/ land managers, as well as private landowners. Information and conservation efforts will be exchanged with the national SFCT. Current state group assignments include producing a GIS-based swift fox distribution/suitable habitat/land ownership map and the development of informational brochures which describe the swift fox and its habitat requirements.

The swift fox reintroduction effort was funded by Defenders of Wildlife with 30 captive-raised foxes provided by the Canadian-based Cochrane Ecological Institute. The Blackfeet Nation, located in northcentral Montana, permitted the release to occur on a tribal-owned ranch of approximately 20,000 acres in size (Fig. 1). The reservation and adjacent lands to the south along the east front of the Rocky Mountains maintain some of the best swift fox habitat and comprises the second largest contiguous prairie grassland region in Montana (Giddings and Knowles 1995, Knowles 1998a). A pre-release survey of the reintroduction site was conducted by Knowles (1998a) to assess habitat suitability and relative prey abundance, both of which were considered very good. The operation secured necessary importation permits and inspections occurred at the U.S./Canada border. Prior to release, the foxes were grouped according to litters and provided water, fed day-old chicks, and contained in covered kennels. Eight portable protective shelters (PPS) were provided at previously selected sites centered over badger excavated ground squirrel burrows (Knowles 1998b). Foxes were released from the kennels in eight groups and had the opportunity to use a PPS or move off into the prairie habitat. According to Knowles (1998b), generally one animal entered a PPS, while others in the group slowly moved off. The release operation itself was considered successful (Wilkinson 1998). To date, two known mortalities occurred from vehicles hitting foxes on a paved secondary highway.

During 1998 FWP committed to funding a statewide (18-20 counties) swift fox distribution survey which will most likely be conducted in 1999. This survey will probably be contracted with a private wildlife/ecological service, with oversight and assistance from FWP. Survey methods will be developed from information on techniques provided by the SFCT and from similar efforts in adjacent states. The survey will be conducted during the swift fox dispersal period (August 15-November 15).

DISCUSSION

Members of the state's swift fox working group are interested in accomplishing the SFCT conservation strategy objectives outlined in Kahn et al. (1997) for Montana. Activities have already been initiated to achieve these as a long-term goal. However, several agencies and organizations were absent from the first meeting and need to participate in the future to make this group completely functional. These would include representatives from Montana Natural Resources and Conservation, Montana Farm Bureau, USDA Natural Resources and Conservation Service, and USDI Bureau of Indian Affairs.

It is uncertain if the swift fox reintroduction effort that took place during 1988 will promote species restoration in Montana. The release site is located in suitable habitat, foxes have immediate access to additional tracts of extensive prairie grassland to the south, and a resident wild swift fox population exists with in 100 miles from the reintroduced group of foxes (Fig. 1). However, none of the released foxes were fitted with radio transmitters (C. Knowles, pers. comm.), which was recommended by FWP, although periodic monitoring through random track searches and observations may be conducted (I. Newbreast, pers. comm.). Any long-term evaluation involving survival and reproduction of reintroduced foxes will be difficult to assess. There is additional uncertainty concerning future releases over the initial planned four-year period, which could be a pivotal factor in accomplishing the apparent goal of establishing a local, self-sustaining swift fox population on the Blackfeet Reservation (C. Smeeton, pers. comm.).

This rather rapidly conceived and implemented reintroduction effort demonstrates the ability of wildlife/land managers and conservation groups to restore swift foxes to vacant habitats (M. Johnson, pers. comm.). This reintroduction also highlights problems which need to be addressed by the SFCT such as prioritizing reintroduction sites on a national basis, develop release site criteria, and to recommend appropriate long-term evaluations of reintroduction activities. It has also generated discussion concerning the role of wild or captive-raised foxes in reintroductions in the United States, although Canada has apparently dealt with this issue. Government agencies and private organizations should be informed when SFCT guidelines exist, while communication among all interested parties should be established early in the process to facilitate discussions on the best use of reintroduction efforts for specific restoration or augmentation purposes.

FWP will utilize a standard species detection (presence/absence) technique recommended by the SFCT which is comparable with other state inventories. Determining current species distribution in the state provides baseline data to measure future population expansion or contractions, through population monitoring activities at three to five year intervals.

The Canadian Swift Fox Recovery Team has expressed initial interested in determining a population estimate for swift fox in northcentral Montana in an effort to combine population estimates for the adjacent Canada/U.S. population. This is anticipated to provide a total area population figure which may actually be closer to their recovery goal. FWP expects to discuss this further assuming Canada remains interested. Field activities could occur during the winter period in 1999-2000.

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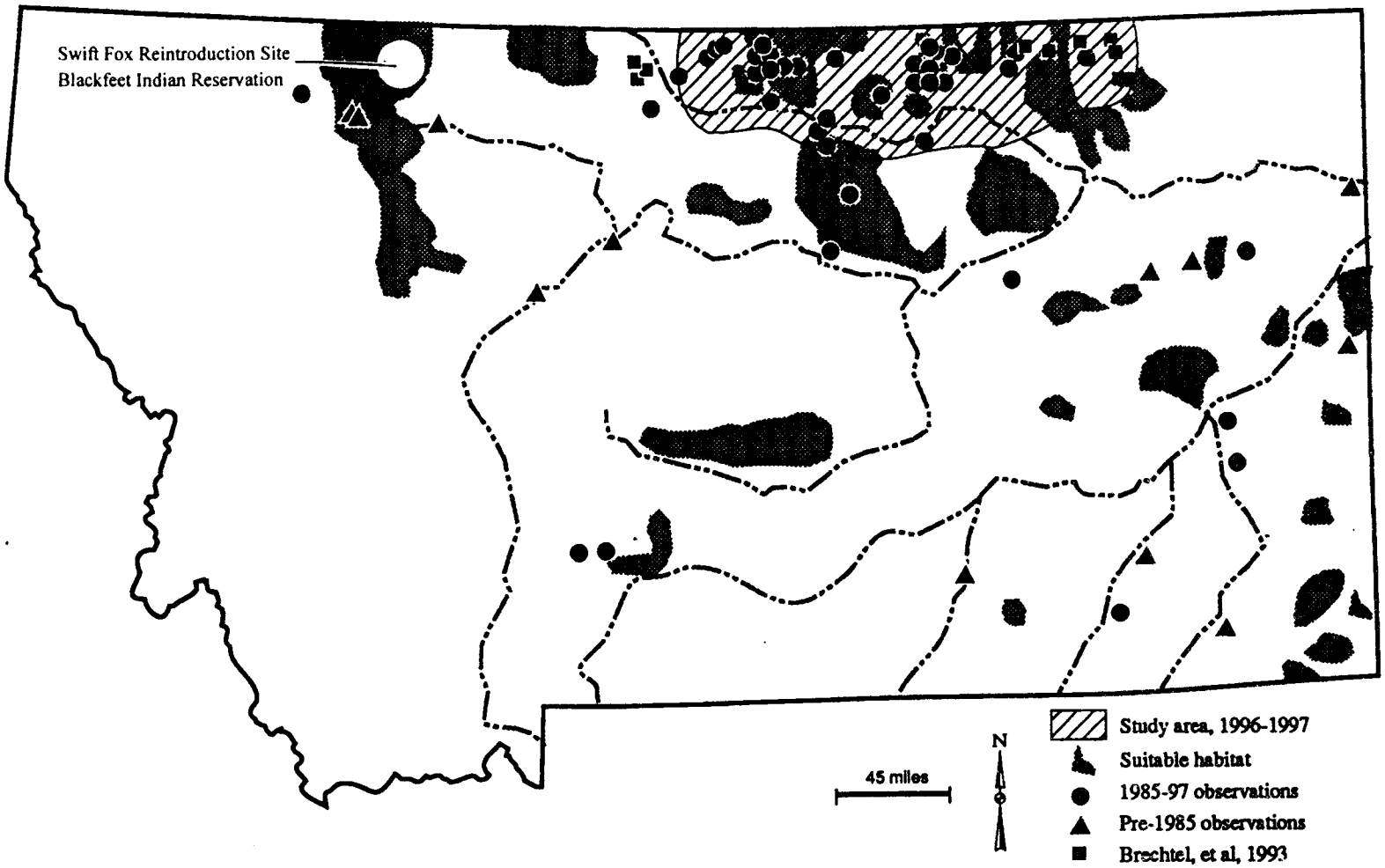

Figure 3. Location of study area and distribution of potential swift fox habitat in Montana based on vegetation and topography (map modified from Montana Natural Heritage Program records) with documented observations of swift foxes. Observations of swift foxes include pre-1985 observations, 1985-1997 observations, and observations from Brechtel et al. 1993.

SWIFT FOX INVESTIGATIONS IN NEBRASKA, 1998

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ABSTRACT

Swift fox (*Vulpes velox*) history and classification in Nebraska and other information on swift fox in Nebraska can be found in previous annual reports of the Swift Fox Conservation Team (Andelt 1995, Andelt 1996, Andelt 1997).

After the completion, in 1997, of a cooperative project between the Nebraska Game and Parks Commission, U.S. Forest Service and USDA-APHIS-Wildlife Services to live-trap swift fox and collect blood samples for genetic analysis, no field investigations were conducted in 1998. Swift fox activities in 1998 were limited to routine compilation of swift fox sighting reports.

INTRODUCTION

Sightings of swift fox in Nebraska by the public, landowners and wildlife professionals have been compiled for years to provide information on distribution and status of the species. Active solicitation of sighting reports by distribution of news releases, mailings to landowners, etc., has increased the number of swift fox sighting reports in previous years but also resulted in a large number of animals, usually coyotes (*Canis latrans*), misidentified as swift fox.

STUDY AREA AND METHODS

Swift fox sighting reports are used to document distribution of the species in Nebraska. Information is acquired from observers and sightings are classified as confirmed, probable or unconfirmed. If available, carcasses are collected to verify identification.

RESULTS

Swift fox sighting reports were not actively solicited in 1998 and only one report was received. That report, from Box Butte County in the Nebraska panhandle, was classified as probable. Reports of swift fox in that area have been verified numerous times in the past.

DISCUSSION

One of the strategies identified in the Conservation Assessment and Conservation Strategy For Swift Fox In The United States (Kahn et al. 1996) is to develop standardized data collection methods and survey protocols for monitoring swift fox populations. Several survey and monitoring techniques have been assessed (Sovada 1996), but recommendations for standardized monitoring and survey techniques have not yet been prepared. In Nebraska, several techniques, including aerial surveys, spotlight surveys and landowner surveys, have been used for monitoring swift fox, with mixed results. When survey and monitoring techniques are developed that yield consistent results, the Nebraska Game and Parks Commission will likely utilize them to monitor

swift fox in Nebraska.

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INVESTIGATION OF FURBEARER OCCURRENCE IN NORTH DAKOTA WITH SPECIAL REFERENCE TO SWIFT FOX--1998

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ABSTRACT

Sections were selected randomly and optimal quarter-sections within those sections were selected on site for survey (n=36). Furbearer occurrence was determined by identifying tracks to species. Presence of red fox, coyote, skunk, and raccoon were determined. No swift fox were detected. Differential reporting rates for red fox and coyote harvests and confirmed swift fox observations indicate swift fox exist at extremely low densities if at all in North Dakota. An additional 13 quarter sections and 16 adjacent non-paved public thoroughfares were selected and examined for furbearer occurrence by species. No difference in occurrence ($P > 0.05$) of occurrence by species was detected in quarter-sections compared to roadsides. A major epizootic of sarcoptic mange is dramatically affecting canid densities and distribution in North Dakota especially in the eastern and northern portions of the state.

INTRODUCTION

Interest in swift fox (Vulpes velox) has increased greatly in recent years. Swift fox were common in North Dakota during pre-settlement times (Bailey 1926, Thwaites 1953); however, the species became very rare about 1880-1900 (Bailey 1926). Swift fox are known to be very rare in North Dakota; however, data are being collected annually with which to make inference concerning the occurrence of the species. Initially southwestern North Dakota has been selected for study, because of occasional reports of possible swift fox in these areas. . The objective of this report is to present the results of a survey to determine relative occurrence of all furbearer species in this area with special reference to swift fox .

STUDY AREA AND METHODS

Surveys were conducted in southwestern North Dakota in 1997. This area is primarily semi-arid prairie grassland with some intermixed cropland and hayland. Topography is generally rolling grassland to rough broken badlands; native hardwoods trees and shrubs occur in the many of the deeper coulees. Climate in North Dakota is typical of sub-arctic continental interiors with hot summers and cold winters.

Track surveys were conducted to determine relative occurrence of furbearers in each quarter section surveyed. The survey was modified from one developed by Sargeant et al. (1993). Timing of the survey minimizes errors in correctly identifying species caused by movement of young, especially in the canids.

Sections were selected randomly for study; within each section one quarter-section study area was selected at the site which had the best potential for identifying furbearer tracks. Some

randomly selected sections had to be relocated to improve field logistics due to remoteness and inaccessibility of some of the original selections or proximity to human habitations. All study areas were surveyed no sooner than 48 hours after a rain. The search pattern consisted of visiting as many locations on each study area as possible on foot within 30 minutes that had potential to reveal furbearer tracks.

Data collected for each quarter-section visited consisted of relative abundance of tracks identified by species (none, scarce, common, abundant), predominant cover type (pasture, hayland, cropland, marsh, idle), relative amount of available track sites (many, moderate, few, almost none), relative soil condition for holding tracks (excellent, good, fair, poor), and the track accumulation period (1 day, 2-3 days, 4-6 days, 7 or more days). Coyote and red fox tracks were distinguished based on size (Allen, unpubl. data). Swift fox tracks are easily distinguished from other canids, because they average about 10 mm shorter than the smallest red fox tracks (Orloff et al., 1993). Data analysis consisted of the examining the number of study areas with furbearer track occurrence by species.

A sample of 13 quarter-sections were selected and examined as above for furbearer tracks to a sample from the nearest public access roadside to that quarter-section for furbearer tracks. No paved roads were included in this testing. Search pattern consisted in examining each sample type for 30 minutes for furbearer tracks. Tracks were identified to species when possible. Differences in numbers of quarter-sections with furbearer tracks were compared to roadsides with furbearer tracks by species with Chi-square.

Population changes are being monitored by spring surveys and computer population modelling. The spread and occurrence of sarcoptic mange is being monitored with data collected from USDA-ADC personnel.

RESULTS

Densities of furbearer species were not determined in this study. Relative occurrence of furbearer species identified on the 41 study areas in 1998 (Table 1) consisted of coyotes (Canis latrans-14x areas), red fox (Vulpes vulpes-20 areas), badger (taxideataus) -1, raccoon (Procyon lotor-8 areas) and skunk (Mephitis mephitis-1 area) . No swift fox tracks were identified on any of the 41 study areas. No visual observation of any furbearer was made on any study area. Eleven of the 41 study areas contained tracks of at least 1 furbearer species.

No differences were found in furbearer occurrence on 13 quarter-sections compared to 16 adjacent roadsides for red fox ($X2=0.775$, df=1, $P=0.379$) for coyotes ($X2=1.421$, df=1, $P=0.233$) for raccoons ($X2=0.082$, df-1, $P=0.775$), or for skunks ($X2=0.001$, df=1, $P=0.978$).

Other relative occurrence data for canids are also available in North Dakota. Since 1970 we have obtained 4 confirmed observations of swift fox in North Dakota. During that same time period there have been 698,665 red fox and 209,144 coyotes sold to North Dakota furbuyers.

Red foxes and coyotes in north-central and eastern North Dakota have been strongly impacted by sarcoptic mange. Population size of coyotes are about ½ and red foxes about ⅓ of

what they were in 1992.

DISCUSSION

Interspecific competition has been well documented between wolves (Canis lupus) and coyotes (Carbyn 1982) and between coyotes and red foxes (Sargeant et al., 1987) in the northern plains. Interspecific competition from other canids (especially coyotes) may be a significant limiting factor in currently existing swift fox populations in Kansas (L. Fox, 1994 Midwest Furbearer Workshop), and in efforts at reintroduction of swift fox in Saskatchewan (L. Carbyn, 1994 Midwest Furbearer Workshop). Ralls and White (1995) noted that although coyote predation on kit fox in California can be severe, they found indications that red fox predation on kit fox may be catastrophic to the population. Data collected in this study indicate that many quarter-section study areas selected in North Dakota probably have red fox or coyotes or both species present. Track surveys should represent a minimum distribution, because some quarter-sections with no canid tracks observed likely had canids present. Conditions for observing tracks in North Dakota are often far from perfect; however, a few good sites in most quarter sections are all that is often needed to identify one or more species of furbearer present. Considering the hypothesis the observations of Ralls and White (1995) suggest and the density and distribution of red fox and coyotes in North Dakota, the potential for viable swift fox populations may be quite remote. This hypothesis certainly warrants further investigation.

Historically, interspecific competition may not have been as severe on swift fox prior to settlement in the region. At that time wolves were the dominant canid, and coyotes were probably very rare (Johnson and Sargeant 1977). With removal of wolves during and after settlement the canid composition changed and coyotes became more abundant, and conditions for swift fox survival may have deteriorated dramatically. If this hypothesis is correct, the probability for existence of viable natural or reintroduced swift fox populations in this area is extremely limited without major alterations to the present canid community. Alteration of the current canid community to include wolves is not a viable management option in an agricultural environment due to conflicts with livestock. Alteration of the canid community to physically remove the coyotes or red fox is not a viable management option due to prohibitive costs of neutralizing canid dispersal into the control area (Allen, unpubl. data).

Numbers of red fox and coyotes sold to North Dakota furbuyers is the minimum number of these species taken, annually. Not all animals are sold after they are taken, and not all pelts sold are sold to North Dakota furbuyers. Given the magnitude of differences of red fox and coyotes taken as compared to confirmed swift fox observations, we again question if swift fox have very much potential for survival in North Dakota considering the number and distribution of these other canids at present.

The present study also illustrates the paucity of data that is obtained from diurnal observations of live furbearers. Few are seen because of the secretive behavior of these species; however, most randomly selected quarter-section study areas with favorable conditions for locating tracks had furbearer tracks present indicating occurrence of one or more species. In the case of swift fox; however, a visual observation would be required in addition to a track observation to confirm their occurrence, and to eliminate any possible error caused by

misidentification of a red fox or coyote pup track. This experimental investigation indicates that various species of furbearers occur on almost all quarter-section study areas, and occurrence of coyotes or red fox or both species is likely on may areas. Other species such as swift fox may be present, but they appear to exist at extremely low levels.

At this point it looks feasible to search public thoroughfare roadsides for tracks of furbearer species and ascertain reliable data on species composition and distribution similar to what would be found on quarter-sections or some other parcel of real estate. This would allow states with problems of access to distribution along public thoroughfares without receiving unnecessary abuse from local private landowners. However, more data needs to be gathered from North Dakota and probably several other locations to reliably determine the potential for this method.

Reintroduction is periodically discussed as an option to expanding distribution into once occupied ranges to augment natural dispersal. Earlier data (Sargeant et al., 1975) shows that red fox have the capacity to change territory size commensurate with densities. Thus, with the lower red fox densities currently present in North Dakota, formerly occupied ranges are still likely completely occupied. Similar, but somewhat more circumstantial, data also exists for coyotes (Andelt 1985). Given this and the current sarcoptic mange epizootic it make little sense to reintroduce swift foxes into areas where 2 major potential mortality agents are present. Subjective cost:benefit analysis indicates the potential for success is virtually non-existent, and the money will be gone.

We identify several research needs for swift fox. We hypothesize that most survey procedures for swift fox that require a behavioral response on the part of the animal to detect this presence in an area will be shown to underestimate distributions compared to control data. This occurs because of shyness behavior in canids especially to foreign objects, lures and placed baits. The potential bias is this: if a lure (e.g. some type of bait, etc.) or object (e.g. live trap or track plate, etc.) is placed in the field and the observer does not detect the animals presence from it, does that mean the animal is not present? The anser is obviously no. In effect, then, the investigator has actually measured the response rate of the animal to the lure or object, and not necessarily the presence of the animal in the area. In addition, sample sizes are restricted, because each sample site requires 2 or more visits by the investigator to collect data effectively multiplying the man-days needed to collect data by the number of visits.

We encounter some problems with track surveys as well, because we do not always detect tracks of a species even though that species is present, and there is potential for error in correctly identifying tracks to species if inexperienced observers are used. The advantage of track surveys is that nothing special is done that requires a behavioral response on the part of the animal to detect his presence; thus, the potential for behavioral bias in the data on the part of the animal is absent. In addition, sample sizes are maximized, because the investigator only needs to visit a sample site once to obtain the desired data. We suspect that all surveys will show swift fox distributions smaller than the true distribution. However, because behavioral bias is lacking, we suspect track surveys will consistently show larger swift fox distributions with the least bias in the data.

We suggest that determining a standardized survey method that eliminates behavioral bias that can be used by all states to determine maximum distribution of swift fox should receive high priority by the SFCT. This is needed in order to make reliable comparisons of maximum distribution, and to interpret differences in distributions over broad physiographic regions or jurisdictions.

We also suggest that geneticists need to demonstrate definitively if swift fox and kit fox are separate species or merely variations of the same species living in different areas. If the 2 species are separate the case for additional research is very strong. If, however, they are the same species the data base for management increases dramatically with inclusion of all the kit fox data, and the case for endangered species classification in any form becomes very weak with inclusion of several other widely spaced life zones in the species distribution.

The most pressing research need for North Dakota is identifying the role of canid interspecific competition on swift fox. If this behavior is as strong as expected for canids in general and red fox in particular, the potential for a future population of swift fox in North Dakota is remote at best. Other data we will need to have determined from areas that have viable populations are detailed information on reproductive performance (litter sizes) by female age class, population age structure at some point during the year, and annual survival rates by age class group and sex.

Table 1. Number and percent occurrence of furbearer tracks by species and county on randomly selected study sites in southwestern North Dakota - 1998

Species	County and number (%) of quarter-sections with tracks found			
	Bowman (n=21)	Slope (n=14)	Golden Valley (n=1)	Total (n=36)
Red Fox	15 (71.4)	2 (14.3)	0	17 (47.2)
Coyotes	4 (19.0)	7 (50.0)	1 (100.0)	12 (33.3)
Striped Skunk	2 (9.5)	0	0	2 (5.6)
Badger	0	1 (7.1)	0	1 (2.9)
Raccoon	5 (26.3)	1 (7.1)	0	6 (16.7)

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SWIFT FOX INVESTIGATIONS IN OKLAHOMA, 1998

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ABSTRACT

A new swift fox (*Vulpes velox*) monitoring survey was initiated in two Oklahoma panhandle counties (Cimarron and Texas) under a Section 6 project investigating swift fox distribution within the species' historical range. The Oklahoma Department of Wildlife Conservation conducted this study with $4,797.75/$1,599.25 in federal/state funds for activities during the 1998 sampling period. Swift fox were detected in 35 of 57 townships in the two county area.

INTRODUCTION

The swift fox (*Vulpes velox*) is classified as a furbearer species in Oklahoma with a year-round closed season with regard to take. The swift fox is also designated as a state species of special concern in Oklahoma. The swift fox has been documented to occur in the Panhandle region as well as in four counties in the northwestern corner of the body of the state. Historic range and geographic distribution for the swift fox in Oklahoma is provided in Hoagland (1995) and Hoagland (1996).

During 1998, Section 6 funds were available to partially fund a new project to conduct a swift fox population distribution survey in northwestern Oklahoma, using track search methodology. The track survey allowed the populations of all terrestrial furbearer species to be monitored in the region. The objectives of this project were to: establish a track search survey to monitor population trends of swift foxes throughout the shortgrass prairie ecosystem in Oklahoma; and develop a baseline database of swift fox distribution and abundance in northwestern Oklahoma. Data collection was initiated in August 1998 and is scheduled to be completed in September 2000. The project is being conducted by the Oklahoma Department of Wildlife Conservation (ODWC).

METHODS

Three ODWC personnel, two county game wardens and 1 wildlife biologist, conducted the track search surveys. All three ODWC personnel had previous experience in reading furbearer tracks and were knowledgeable with the area to be surveyed. Because the project received less than one quarter of the funding requested, only two of the seven counties targeted for the survey were completed, Cimarron and Texas counties. Every other township in the two county area was surveyed for furbearer tracks. Survey sites within each township were carefully selected, based on areas with the highest probability of finding swift fox tracks if swift foxes were present. Thus, survey locations focused on areas with herbaceous range habitat, the best available substrate for tracks, little vehicle traffic, and a lack of human disturbance. The same

tracking sites will be used every year unless major changes occur that may bias the survey, in which case new survey sites will be selected.

All track surveys were conducted during the months of August and September, 1998. Two counties (Cimarron and Texas) were surveyed for a total of 57 survey townships/sites. Track searches were conducted with a minimum search time per township of 30 minutes and a maximum of 2 hours. Once a swift fox track was found, the time of search was recorded. The tracker continued searching if the track was found during the first 30 minutes of the search period, or moved on to the next township, after the initial 30 minutes. Since survey success was affected by time of day and weather conditions, track searches were conducted when possible during morning hours and 24 hours following a rainfall event. Because of unusual precipitation patterns during August, 1998, it was difficult to follow the 24-hour rule, thus track searches were frequently conducted the morning following a nighttime rain event.

For the purpose of selecting track search locations, broad habitat categories were delineated within the study area using ArcView GIS 3.0 based on United States Geological Survey (USGS) land use and land cover data at 1:250,000 (USGS 1990). Classification codes used in data analysis included urban/industrial, cropland, including Conservation Reserve Program grasses (CRP), herbaceous rangeland, shrub rangeland, mixed rangeland, deciduous forest, evergreen forest, and water/wetlands. Habitat categories were ground verified for the townships surveyed. The habitat type recorded where swift fox and other furbearer tracks were located was recorded as range, CRP, fallow, winter wheat, irrigated crop (primarily corn), other crop (e.g. milo, soybeans), and juniper mesa.

RESULTS

All 57 townships in the two county area were successfully searched for swift fox tracks. The total cost for surveying the 10,076.05 km^2 area was $5,070.00, which averaged $89.00 per township. Trackers drove an average of 35 miles per township and averaged 14 days to complete the surveys. Swift fox tracks were detected in 35 (61.4%) of the townships surveyed (Figure 1). For each township where swift foxes were successfully detected, it took an average of 39 minutes to detect the first track (range 4 to 105 minutes). Swift fox tracks were detected within the first 30 minutes in 17 of the 35 townships. In 29 townships, swift fox tracks were found within the first hour. Only six townships found swift fox tracks during the second hour of tracking. Twenty-eight townships had only one set of swift fox tracks observed during the initial 30 minutes; six townships had two sets of swift fox tracks detected, and in one township swift tracks were observed up to four times within the initial 30 minute search interval.

Swift fox tracks were detected on two-track and dirt roads in rangeland habitats 59% of the time, compared to 14% alongside CRP, 10% alongside or within fallow crop fields, 10% alongside or within other crop fields, and 2% each in winter wheat fields, irrigated crop fields, and pinyon-juniper mesa land (Figure 2). Habitats searched in townships where swift fox tracks were not observed included 41% rangeland, 19% CRP, 14% each in fallow, 14% other crop, 7% in irrigated crop, and 3% each in winter wheat and pinyon-juniper mesa land. Cropland, including CRP lands, composed 51.8% of the two-county area. Rangeland comprised 46.1% of the area, with 88.5% of the rangeland existing as herbaceous rangeland, 0.008% as shrub rangeland, and 11.5% as mixed rangeland. The rangeland plant communtity consisted primarily of blue grama (*Bouteloua gracilis*)-buffalograss (*Buchloe dactyloides*), interspersed with

sandsage (*Artemesia filifolia*). The mixed rangeland also consisted predominately of blue grama and buffalograss, along with yucca (*Yucca glauca*) and cholla cactus (*Opuntia imbricaria*).

Other furbearers detected with the survey included, coyote (*Canis latrans*) in 55 townships (96.5%), badger (*Taxidea taxus*) in 28 townships (49.1%); raccoon (*Procyon lotor*) in 15 townships (26.3%), striped skunk (*Mephitis mephitis*) in 12 (21.1%) townships, domestic dog (*C. familiaris*) in 10 (17.5%) townships, domestic cat (*Felis catus*) in 5 (8.8%) townships, and bobcat (*Lynx rufus*) in 2 (3.5%) townships. Tracks of black-tailed jackrabbits (*Lepus californicus*) and eastern cottontails (*Sylvilagus floridanus*) were observed at 39 and 27 townships, respectively, and prairie dogs (*Cynomys ludovicianus*) were seen in 14 townships while surveying tracks. Information concerning jackrabbits, cottontails and prairie dogs, however, was only noted casually, and not specifically requested.

DISCUSSION

Initial results in Oklahoma confirm those from Kansas (Roy et al. 1997), and indicate that this method has been an effective technique for conducting landscape-scale presence/absence surveys for swift fox. Because the Oklahoma survey included salary and fringe benefits for the three permanent, full-time employees conducting survey, the average expense per township in Oklahoma was slightly greater than in Kansas (Roy et al. 1997). Data quality, however, was enhanced in the Oklahoma survey by using in-house trackers. When compared with the previous survey conducted in the Oklahoma panhandle, swift foxes were detected more thoroughly throughout the 10,076 km^2 area at nearly one half the cost. Because track searches were restricted to habitat believed best for swift fox and most favorable for finding tracks, costs were controlled and high detection rates were achieved.

Swift fox tracks were encountered more often in rangeland habitats than any other habitat type, however, rangeland habitat was the habitat type searched whenever it was available within a survey township. The use of county game wardens to conduct the survey aided tremendously in the ability to access private rangeland throughout the two county area. Swift fox tracks were observed in agricultural areas in both Cimarron and Texas counties, but agricultural areas were not searched in proportion to their availability. If cropland and rangeland were both present in a township, only the rangeland was most likely surveyed. It would be interesting in the future to survey proportionately the different habitat types to see if swift fox use cropland when rangeland is readily available.

Most tracks, if they were found at all, were found within the first 60 minutes (51% detection rate). Limiting the amount of time per township could help provide greater coverage, especially if Section 6 funding is limited next year. It is possible that time could be reduced to 60 minutes in Texas and Cimarron counties, but kept at 120 minutes in the eastward range, since it may be that swift fox occur at lower densities in the eastern part of their historical range in Oklahoma.

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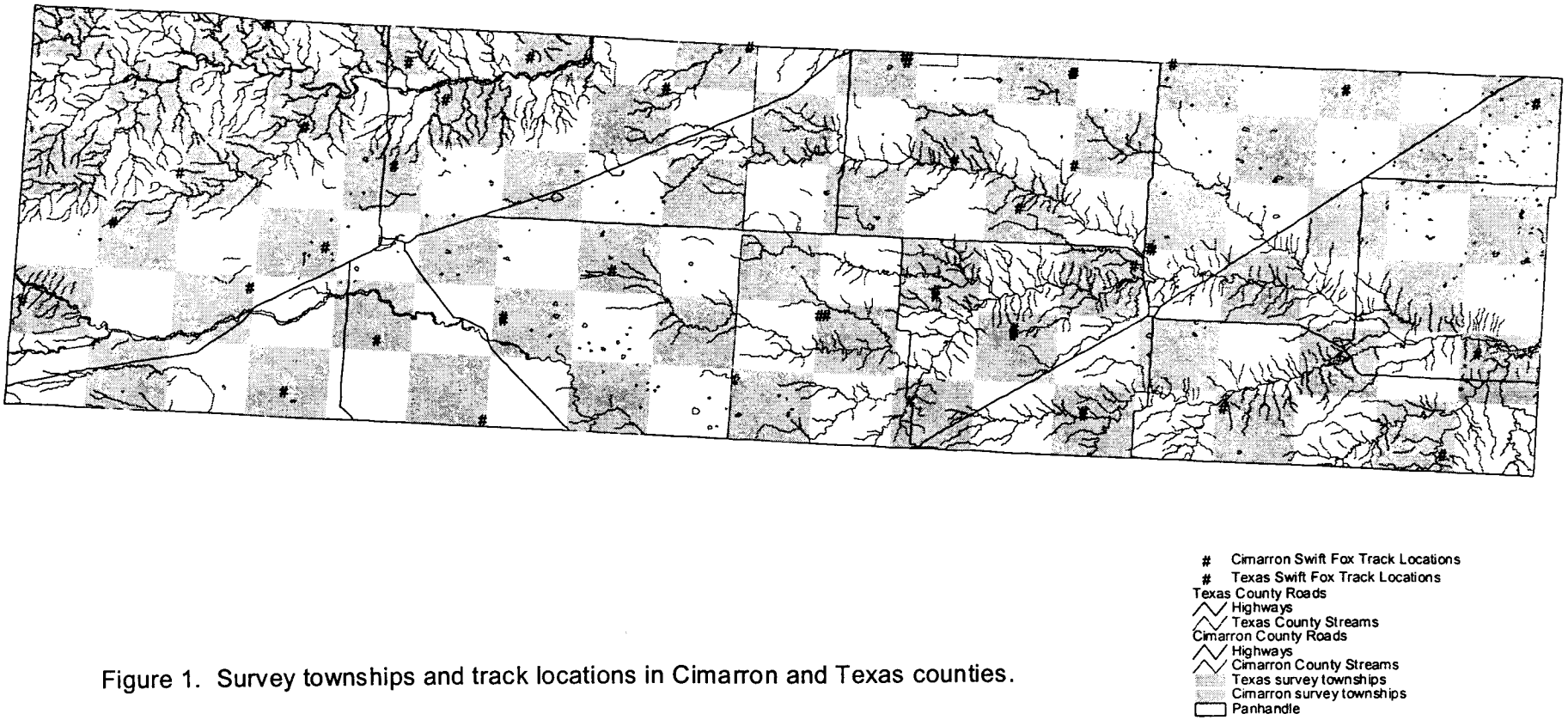

Figure 1. Survey townships and track locations in Cimarron and Texas counties.

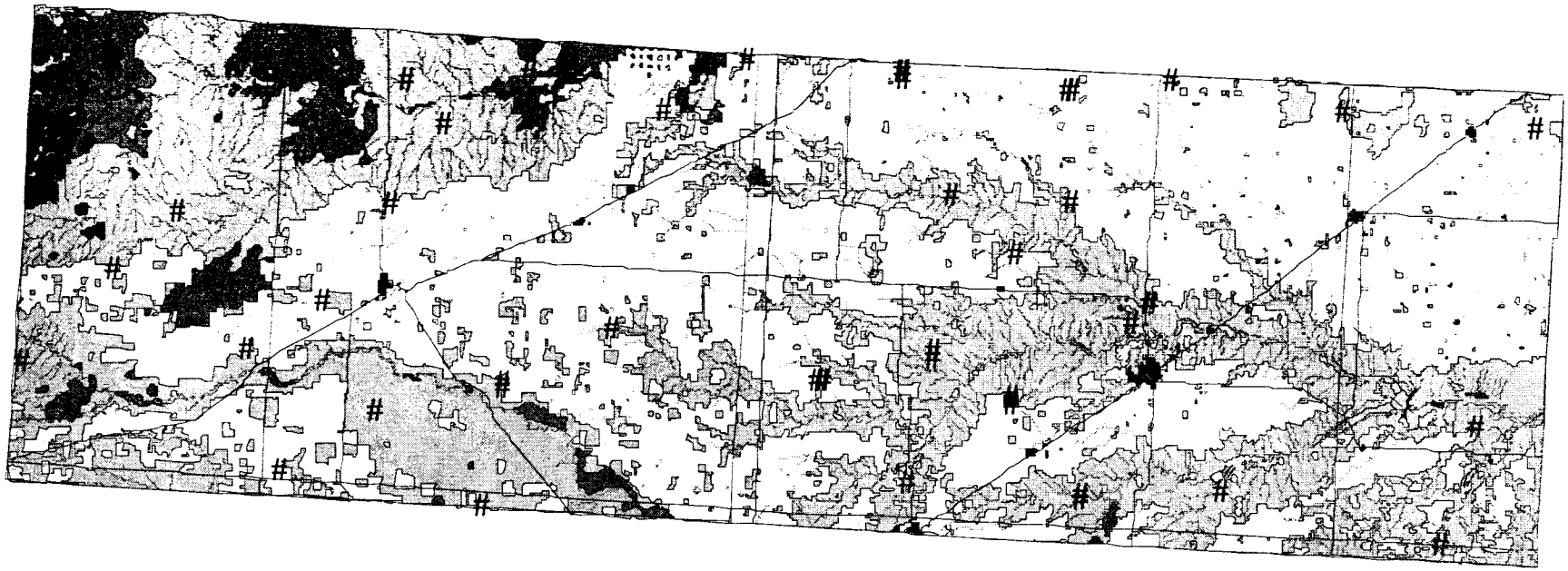

Figure 2. Swift fox track locations and habitat availability in Cimarron and Texas counties

SURVEY OF SWIFT FOX (*VULPES VELOX*) IN PENNINGTON AND BENNETT COUNTIES, SOUTH DAKOTA

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ABSTRACT

Quarter-section track and spotlight surveys were conducted from 25 September to 31 December 1998 to document presence of swift fox (*Vulpes velox*) in eastern Pennington (52 quarter-sections) and central Bennett (26 quarter-sections) counties. Swift fox were not detected by either method. Hard soils and agricultural traffic reduced track survey effectiveness; therefore, swift fox may exist in study areas in very low densities. Coyotes (*Canis latrans*), domestic dogs (*Canis familiaris*), and red fox (*Vulpes vulpes*) were the most abundant canids in both study areas.

INTRODUCTION

Historic distribution of swift fox (*Vulpes velox*) in South Dakota included all but tallgrass prairie habitats (Jones et al. 1983). Currently, swift fox are listed as a state threatened species and presence has been recorded in 10 counties west and 3 counties east of the Missouri River since 1963 (South Dakota Natural Heritage Database 1995). Since 1995, verified sightings of swift fox have been restricted to Fall River and Shannon counties, South Dakota (Kruse et al. 1995, Dateo et al. 1996). Two adult and three juvenile swift fox were observed in recent research efforts in Fall River (1995) and Shannon (1995, 1996) counties (Kruse et al. 1995, Dateo et al. 1996). No swift fox were observed during spotlight surveys of Bennett County in 1997-98 (Althoff et al. 1997) and the last verified sighting in Bennett County was in 1995. The purpose of this study was to use track surveys and spotlighting to document swift fox presence in Badlands National Park, Conata Basin in eastern Pennington County, and in Bennett County, South Dakota.

STUDY AREA

Track surveys were conducted within a 25 km^2 (18 km^2 for spotlighting) portion of eastern Pennington County and 11 km^2 (12 km^2 for spotlighting) portion of central Bennett County, South Dakota (Fig. 1). Surveys within Pennington County were conducted in the Badlands Wilderness Area of Badlands National Park and in Conata Basin within the Buffalo Gap National Grassland. Badlands terrain is composed of eroded canyons, buttes, and spires with interspersed prairie areas composed mostly of fine clay soils of the White River group (Nielsen 1996). Excluding the Little White River, topography in central Bennett County is gently sloping plains composed of silt loams (Chamberlin and Radeke 1971). Surveys in Pennington County were conducted entirely on public land, whereas only 15% of survey areas in Bennett County

were publicly owned. Public survey areas included South Dakota Game Production Areas and LaCreek National Wildlife Refuge.

Dominant vegetation within Badlands and Conata sites includes blue grama (*Bouteloua gracilis*), needle-and-thread (*Stipa comata*), and buffalo grass (*Buchloe dactyloides*) interspersed with western wheatgrass (*Agropyron smithii*) and green needlegrass (*Stipa viridula*) (Johnson and Nichols 1982). Inland saltgrass (*Distichlis spicata*) and little bluestem (*Andropogon scoparius*) predominate near drainages whereas curly-cup gumweed (*Grindelia squarrosa*) and broom snakeweed (*Gutierrezia sarothrae*) are common in highly eroded areas (Weedon 1990). Common crops are winter wheat, alfalfa, barley, oats, rye, corn, and sorghums (Chamberlin and Radeke 1971). Land uses are as follows: rangeland, including native hayland (69%), cropland (22%), pastureland and tame hayland (5%), and woodland (2%) (Baumberger 1977). Observations in 1998 indicate cropland and rangeland were dominant cover types in 79% of study areas while 21% was either marsh or idle.

METHODS

Track and spotlight surveys were conducted from 25 September to 31 December 1998 in eastern Pennington and central Bennett counties, South Dakota. This timing of study period reduced error caused by track size of young and corresponded to increased detection rates of Kahn and Beck (1996) and Sovada and Roy (1996). Unverified sightings of swift fox by United States Forest Service, Badlands National Park, and South Dakota Department of Game, Fish and Parks personnel served as focal points of survey efforts.

Features yielding predictable tracking surfaces (e.g., drainages, wetlands, and 2-track roads) were searched within each quarter-section whereas other features (e.g., pasture gates, prairie dog towns, and game trails) were surveyed opportunistically to determine relative occurrence of mammals (Sargeant et al. 1993, Allen 1996). Study areas were visited no sooner than 24 hours following precipitation and searched until approximately noon each day. Number of track sets and sign per species, predominant cover type, track accumulation period (days), relative amount of trackable sites, and soil condition were recorded for all features searched (Allen 1996). Canid tracks were categorized by length according to S. Allen (North Dakota Game and Fish Department; unpubl. data, 1996) and Olson et al. (1997). Tracks 39 mm or less in length were identified as swift fox and tracks 40 to 42 mm long were placed in a red fox (*Vulpes vulpes*)/swift fox overlap category.

Following track surveys, spotlighting surveys were conducted using a 1-million candlepower spotlight to visually confirm presence of tracked species. Spotlighting was conducted using a vehicle, where possible, along all roads in the study area and traveling speed ranged from 8 to 40 kmph. The spotlight was aimed out the left side of the vehicle and one side of a road was surveyed at a time. Both sides of a road were surveyed in the same evening. When spotlighting on foot, areas were walked primarily in transect fashion, but stationary spotlighting was conducted where raised topography allowed larger viewing areas.

RESULTS

Mammals encountered during surveys are listed in Table 1.

Pennington County

No swift fox tracks were found within the 52 quarter-section study area while primarily searching drainages (39.7 hr.), game trails (11.9 hr.), and 2-track roads (4.8 hr.) for a total of 62.3 search hours. However, one potential swift fox scat was found. Most frequently encountered non-ungulate (i.e., canids, pocket gophers) tracks/sign included coyotes (*Canis latrans*), northern pocket gophers (*Thomomys talpoides*), black-tailed prairie dogs (*Cynomys ludovicianus*), and a coyote/red fox category (Table 2). Cover type was predominantly idle (96%) and mean track accumulation period was 2.95 days (n=20, S.E.=0.38).

Swift fox were not visually observed during 7 nights (28.5 total hours) of spotlighting primarily near prairie dog towns (10.1 hr.), gravel roads (6.5 hr.), and drainages (5.7 hr.). Fourteen coyotes, 12 black-tailed jackrabbits (*Lepus californicus*), 3 porcupines (*Erethizon dorsatum*), 2 eastern cottontails (*Sylvilagus floridanus*), 2 badgers (*Taxidea taxus*), 2 raccoons (*Procyon lotor*), 2 domestic cats (*Felis domesticus*), and 1 red fox were seen during spotlight surveys.

Bennett County

No swift fox tracks were found within the 26 quarter-section study area during 10 search days. Two-track roads (11.6 hr.), drainages (10.1 hr.), and gravel roads (3.0 hr.) were searched most often in 28.2 hours of tracking. Most frequently observed non-ungulate tracks/sign included coyotes, pocket gophers (*T. talpoides, Geomys bursarius*), and domestic dogs (*Canis familiaris*) (Table 2). Mean track accumulation period was 16.6 days (n=10, S.E.=2.3).

Swift fox were not visually observed during 7 nights (22.5 total hours) of spotlighting prairie dog towns (11.2 hr.), drainages (6.6 hr.), and other features (e.g., 2-tracks roads and wetlands). Thirteen coyotes, 13 eastern cottontails, 11 domestic dogs, 4 mink (*Mustela vison*), 3 white-tailed jackrabbits (*Lepus townsendii*), 3 porcupines, 2 raccoons, and 2 unidentified jackrabbits (*Lepus* spp.) were observed during spotlight surveys.

DISCUSSION

Hard soils (Roy et al. 1997) in Badlands National Park and vehicle traffic due to agricultural harvest (Roy et al. 1997) in Bennett County reduced the chance of detecting swift fox tracks. United States Forest Service (D. Sargeant, pers. comm. 1998) and Badlands National Park (D. Albertson, pers. comm. 1998) employees have reported swift fox sightings, however, their spotlighting effort per swift fox observation was higher than what was achieved in 1998 research activities. Because Allen (1997) and Roy et al. (1997) indicated that quarter-section track surveys can fail to detect low density swift fox populations, the above information may suggest that swift fox are present in Pennington and Bennett counties but at low density.

Past research suggests that coyotes limit swift fox population size through interspecific competition (Kruse et al. 1995, Dateo et al. 1996, Althoff et al. 1997). It has been documented that gray wolves prey upon coyotes (Carbyn 1982) and coyotes prey upon red fox (Sargeant et al. 1987) and kit fox (*Vulpes macrotis*) (Ralls and White 1995). Cypher and Spencer (1998) noted that coyotes were the primary cause of kit fox mortality (interference competition) and food habit analysis suggested exploitive competition between the two species. Kruse et al. (1995) suggested that interactions between swift fox, coyotes, and red fox led to den abandonment by swift fox and Dateo et al. (1996) noted that 62% of carbon-plate visitations were by canids larger

than swift fox. In addition, coyotes and red fox predominated spotlight observations in Fall River and Shannon counties in 1995 and 1996 (Kruse et al. 1995, Dateo et al. 1996). Furthermore, coyotes were the most observed canid in Bennett County in 1997 (Althoff et al. 1997). Surveys in 1998 indicate that interspecific competition with larger canids may be limiting swift fox population size. Possible evidence includes the facts that coyotes were predominant in track and spotlight surveys in both Pennington and Bennett counties, domestic dogs were found in both study areas, and coyote-hunting dogs are bred within Bennett County study areas.

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Table 1. Mammals detected in Pennington County and Bennett County, South Dakota, 1998.

Species		Pennington County (P=Present	Bennett County A=Absent)
Desert Cottontail	*(Sylvilagus audubonii)*	P	A
Eastern Cottontail	*(Sylvilagus floridanus)*	P	P
Black-tailed Jackrabbit	*(Lepus californicus)*	P	P
White-tailed Jackrabbit	*(Lepus townsendii)*	A	P
Least Chipmunk	*(Tamias minimus)*	P	A
Thirteen-lined Ground Squirrel	*(Spermophilus tridecemlineatus)*	P	P
Black-tailed Prairie Dog	*(Cynomys ludovicianus)*	P	P
Northern Pocket Gopher	*(Thomomys talpoides)*	P	A
Plains Pocket Gopher	*(Geomys bursarius)*	P	P
Beaver	*(Castor canadensis)*	A	P
Deer mouse	*(Peromyscus maniculatus)*	P	P
Northern Grasshopper Mouse	*(Onychomys leucogaster)*	P	P
Bushy-tailed Woodrat	*(Neotoma cinerea)*	P	A
Muskrat	*(Ondatra zibethicus)*	P	P
Porcupine	*(Erethizon dorsatum)*	P	P
Domestic Dog	*(Canis familiaris)*	P	P
Coyote	*(Canis latrans)*	P	P
Red Fox	*(Vulpes vulpes)*	P	P
Raccoon	*(Procyon lotor)*	P	P
Black-footed Ferret	*(Mustela nigripes)*	P	A
Mink	*(Mustela vison)*	A	P
Badger	*(Taxidea taxus)*	P	P
Striped Skunk	*(Mephitis mephitis)*	P	P
Domestic Cat	*(Felis domesticus)*	P	A
Mountain Lion	*(Felis concolor)*	P	A
Bobcat	*(Lynx rufus)*	P	P
Mule Deer	*(Odocoileus hemionus)*	P	P
White-tailed Deer	*(Odocoileus virginianus)*	A	P
Pronghorn	*(Antilocapra americana)*	P	A
Bison	*(Bison bison)*	P	A
Mountain Sheep	*(Ovis canadensis)*	P	A

Table 2. Percentage of searched quarter-sections containing specific track sets within Pennington County and Bennett County, South Dakota, 1998.

Species	Pennington County	Bennett County
Coyote	0.69	0.81
Northern Pocket Gopher	0.67	---
Northern and Plains Pocket Gopher	---	0.77
Black-tailed Prairie Dog	0.61	0.46
Coyote - Red Fox (overlap)	0.39	0.42
Red Fox	0.23	0.27
Black-tailed Jackrabbit	0.21	0.15
Porcupine	0.21	0.12
Badger	0.21	0.42
Striped Skunk	0.15	0.23
Eastern Cottontail/Desert Cottontail	0.14	0.31
Raccoon	0.14	0.46
Bobcat	0.12	0.12
Domestic Dog	0.10	0.50
Red Fox - Swift Fox (overlap)	0.04	0
Mountain Lion	0.02	0
White-tailed Jackrabbit	0	0.12
Mink	0	0.19
Swift Fox	0	0

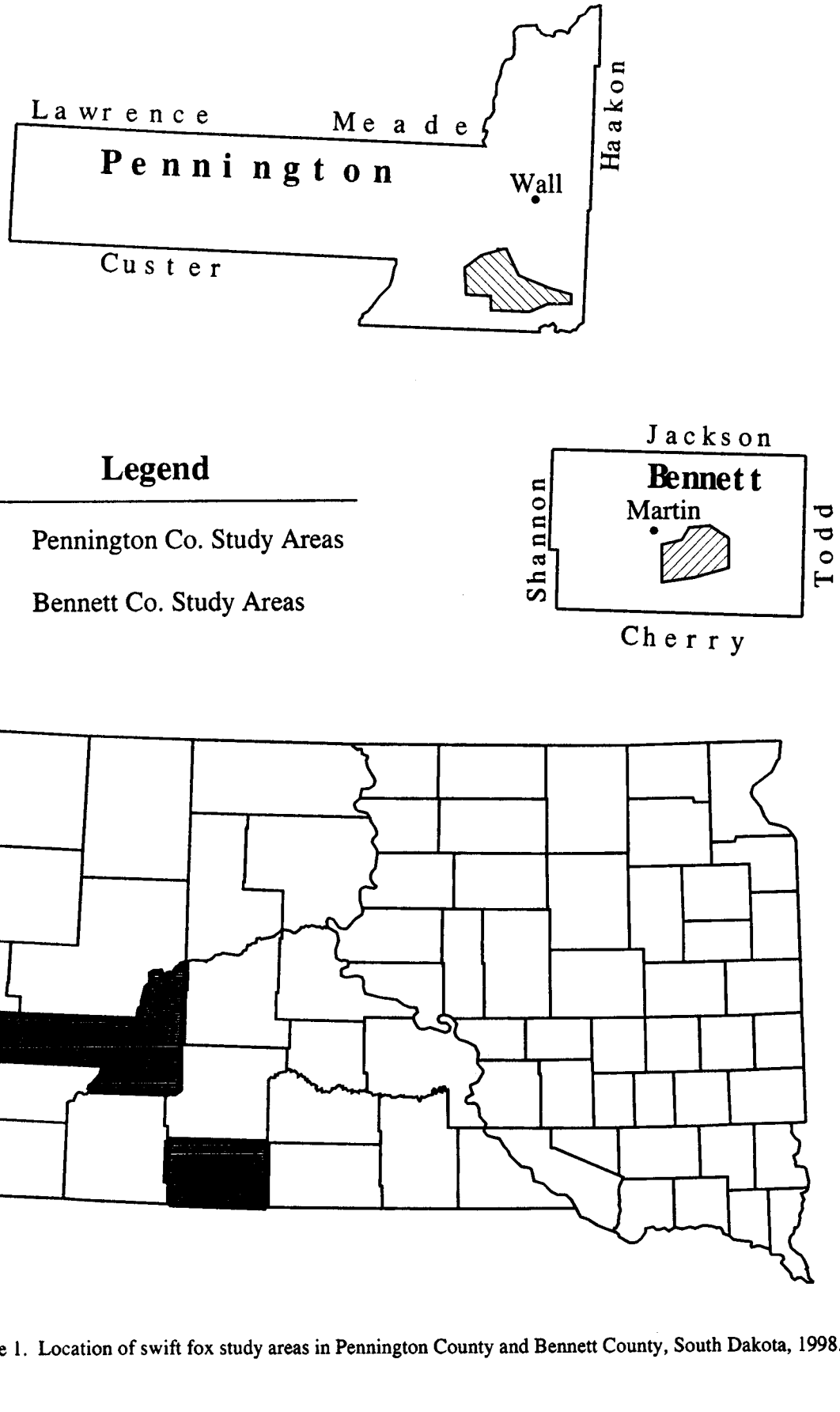

Figure 1. Location of swift fox study areas in Pennington County and Bennett County, South Dakota, 1998.

SWIFT FOX INVESTIGATIONS IN TEXAS, 1998

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ABSTRACT

Annual monitoring of swift fox (*Vulpes velox*), and the initiation of a swift fox/coyote (*Canis latrans*) interaction study were the 2 activities accomplished in 1998. In addition to these activities, the presence of swift fox was verified in Lipscomb County. Annual monitoring of swift fox populations was conducted at two sites in the Panhandle for the second consecutive year. Methods used to monitor swifts included spotlighting and trapping. However, spotlight routes and trapping efforts have been modified from 1997 methodology in order to accommodate research activities being conducted concurrently at both sites.

INTRODUCTION

According to Jones et al. (1987), only 20 counties in Texas have reports of swift fox in the literature or museum specimens. However, most historical range maps include 78 counties in the Panhandle and West Texas. Today we estimate that 25 counties still contain sufficient quality and quantity of habitat to support swift fox, while only three counties have verified reports in the last 10 years (Fig. 1). In light of the vast amount of potentially suitable but unoccupied habitat which exists in Texas, we initiated research to determine the effects that coyotes have on the habitat use, home ranges, and survival of swifts, and further, the ability of coyotes to prevent swifts from re-colonizing otherwise suitable habitat.

METHODS

Annual monitoring of swifts was conducted in 1998 at two locations in the Texas Panhandle: (1) a rangeland site on the Rita Blanca National Grassland in Dallam County,

and (2) an area interspersed with rangeland, cultivated fields, and CRP fields on private land in Sherman County. Both monitoring sites were also selected as study sites for the swift fox/coyote interaction study. Therefore, annual monitoring efforts were modified to comply with research objectives. Home ranges, densities, habitat use, and survival rates of both swift foxes and coyotes will be compared within and between study sites. Swift foxes were captured using 27 x 30 x 80 cm Havahart live-traps. Coyotes were captured using padded-jaw leghold traps. Diets of swift foxes and coyotes will also be compared to determine if competition exists for food resources. To determine the effects that coyotes have on the ecology of swift foxes, coyotes will be removed from 1 study site during the second year of the study. Trapping of swift foxes occurred from August through December 1998, and will continue through spring 1999.

Methods used to conduct annual monitoring at both sites included spotlight surveys and prolonged saturation trapping using live-traps. Monitoring of the Sherman County site consisted of a 15-mile spotlight route conducted during two consecutive nights, and a total of 488 trapnights. Monitoring efforts on the Dallam County site consisted of a 16-mile spotlight route (2 nights), and 275 trapnights. The spotlight route was the same as 1997 on the Sherman County site but shortened from 29 mile to 16 mile on the Dallam County site in order to restrict survey activities to the study area only. Trapping efforts were increased from 20 and 24 trapnights in 1997 to 488 and 275 trapnights at the Sherman and Dallam county sites, respectively.

RESULTS

On the Sherman County study site, 12 swift foxes were captured 43 times in 488 trapnights (0.09 foxes/trapnight). This sample included 2 adult males, 1 adult female, 2 juvenile males, and 7 juvenile females. Radio-collars were placed on 11 swift foxes (one juvenile male was not radio-collard due to its small size). Three swift foxes on this study site were killed by coyotes during the fall of 1998, resulting in a fall survival rate of 64%. Five coyotes were captured in 235 trapnights (0.02 coyotes/trapnight). Trapping for coyotes will continue at this study site in spring 1999.

On the Dallam County site, 15 swift foxes were captured 24 times in 275 trapnights (0.09 foxes/trapnight). This sample included 3 adult males, 3 adult females, 5 juvenile males, and 4 juvenile females. Radio-collars were placed on all 15 foxes. Five swift foxes were killed by coyotes during the fall of 1998, resulting in a fall survival rate of 67%. Trapping for coyotes at this study site will begin in the spring of 1999.

Annual monitoring (spotlight surveys) at the Sherman County site produced a 2 night total of 10 swifts observed on 30 miles of survey route (1 fox/3 miles). These results were similar to spotlight surveys conducted in 1997 which produced 8 swift observations on 30 miles of survey route (2-night total) for an average of 1 fox/3.75 miles. Spotlight surveys on the Dallam County site showed a decrease from 6 swift observations on 58 miles of route (1 fox/9.7 miles) in 1997 to 2 swift observations on 32 miles of route (1 fox/16 miles).

A verified swift fox sighting was reported in Lipscomb County during the spring of 1998. A TPWD biologist conducting Lesser Prairie-chicken surveys observed the swift at close range as it moved across a prairie dog town. This sighting was made much further east and in dramatically different vegetation than other recent swift observations. The land-cover is typically mid to tall grass prairie on rolling deep sand, interspersed with short grasses between the dunes on tighter soils.

DISCUSSION

The current distribution and numbers of swift foxes may be affected by coyotes. Similar to our initial results, research in Colorado and Kansas has indicated that the largest cause of mortality for swift foxes was predation by coyotes (Covell 1992; Sovada et al. 1998). Due to this high mortality, swift foxes may attempt to avoid contact with coyotes. Therefore, coyotes may also affect the local spatial distributions and habitat use of swift foxes. Competition may also exist between swift foxes and coyotes for food resources. By removing coyotes from 1 site during the second year of the study, we will be able to compare survival, home ranges, habitat use, and spatial distributions of swift foxes with and without the presence of coyotes.

Swift foxes may require large expanses of short grass or mid grass prairie and, consequently, cultivation of prairies may have been detrimental to the species (Egoscue 1979; Samuel and Nelson 1982; Scott-Brown et al. 1987). However, swift foxes were found to utilize cultivated fields in Kansas (Sovada et al. 1998), Oklahoma (Kilgore 1964), and Texas (Cutter 1958). The use of CRP fields by swift foxes has not been studied. Habitat use by swift foxes, especially in fragmented landscapes, needs to be determined to assess the importance of different land-covers for the species. Our study will compare habitat use and home ranges of swift foxes in both a fragmented landscape (rangeland, cultivated fields, and CRP fields) and a homogeneous landscape (rangeland).

Comparison of total number swifts trapped and total number of swifts observed during spotlight surveys provides valuable insight into the effectiveness of our monitoring procedures at both sites. We plan to evaluate the ability of other survey methods such as track searches, scent stations, and time of year, to accurately monitor population trends over time. The spotlight route on the Sherman County site was designed to sample every square mile within the study area. During the 2-night survey period in August, we observed 10 swifts (4 the first night and 6 the second night). Saturation trapping of the same area during the same period produced only 12 different individuals. We will repeat the survey during the same period next year with the ability to identify individual animals during spotlighting through telemetry.

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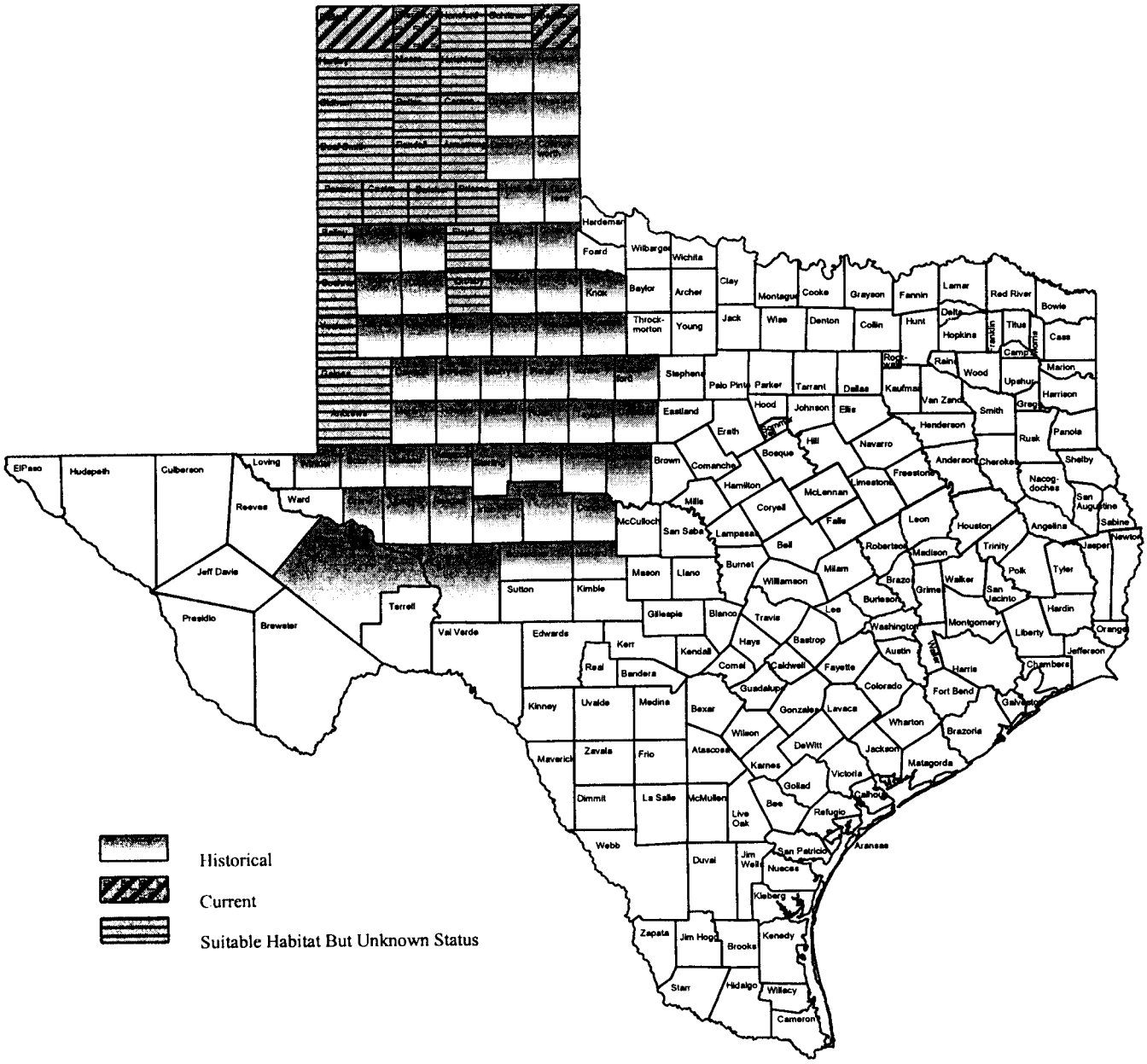

Figure 1. Historical swift fox range, current known distribution, and potentially suitable habitat in Texas.

Swift Fox Detection Probability in Southeast Wyoming

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INTRODUCTION

Efforts to increase knowledge of swift fox (*Vulpes velox*) ecology accelerated after the swift fox was proposed for listing as an endangered species in 1992. In June of 1995, the U.S. Fish and Wildlife Service concluded that listing of the swift fox was warranted but precluded, giving affected states the opportunity to gather additional data on the species. The Swift Fox Conservation Team was formed to develop management objectives for the species, and a Conservation Assessment and Conservation Strategy was drafted to identify steps to be taken to ensure swift fox survival. Identification of reliable techniques to monitor swift fox population status was one of the primary needs identified by the conservation strategy (Luce and Lindzey 1996).

Numerous techniques have been used to detect swift fox presence, such as scent stations with tracking media (Hoagland 1996), tracking plate transects (Woolley et al. 1995, Mote 1996, Dieni et al. 1997), spotlighting (Hillman and Sharps 1978, Woolley et al. 1995, Mote 1996, Dieni et al. 1997), and scat surveys (Sovada and Roy 1996, Dieni et al. 1997). But, the probability of any of these techniques detecting swift foxes when they are present is unknown. Ideally, methods to detect presence and monitor population trends should have a high and consistent probability of detecting foxes.

Tracking plates are relatively inexpensive, easy to use, and tracks left on a hard surface are readily identifiable, making this technique an attractive detection method. Tracks of the similar San Joaquin kit fox (*Vulpes macrotis mutica*) left on tracking plates were readily distinguishable from other wild canids (Orloff et al. 1993). Knowledge of the likelihood of detecting swift fox when they are present is a necessary first step in the development of a reliable population monitoring program (Olson et al. 1977).

The primary objective of this research was to estimate the probability of detecting 1 swift fox of a pair using tracking plate transects within a pair's home range. This estimate of detection probability would facilitate the development of a statewide monitoring program. We also wanted to test the simplifying assumption that suitable habitat occupied one year would be occupied in subsequent years if the population had not declined.

STUDY AREA

Our study was conducted on the southern edge of the Shirley Basin in northwestern Albany County, near Medicine Bow, Wyoming. The area was about 220 km^2 in size, with an average elevation of 2,075 m (6800 ft). The sagebrush steppe and mixed grass prairie vegetation communities that characterized the area were dominated by grasses interspersed with patches of low-growing (<1 m) sagebrush (*Artemisia*) and taller greasewood (*Sarcobatus vermiculatus*). The area's flat to gently rolling terrain was interspersed with numerous dry lakebeds and saline lakes. Climate was characterized by long, cold, snowy winters and warm, dry summers. Precipitation averaged 26 cm (10.3 in), including 59 cm (23 in) of snow annually (Pers. Comm. Medicine Bow town office). Other predators present on the area included badgers (*Taxidea taxus*), coyotes (*Canis latrans*), golden eagles (*Aguila chrysaetos*), and ferruginous hawks (*Buteo regalis*). No red foxes (*Vulpes vulpes*) were seen on the study area during the course of study. White-tailed prairie dog (*Cynomys leucurus*) colonies of variable size were present. Most of the study area was privately owned and used principally for cattle grazing. Human developments consisted of fences, windmills, stock ponds, and secondary roads.

METHODS

Swift foxes were first captured on the study area in the spring of 1996 (Dieni et al. 1997). We captured swift foxes using Tru-catch live traps baited with butcher scraps. In the spring of

1997 and 1998 we trapped previously collared foxes to replace radio-collars, and captured new foxes. Traps were checked twice nightly to minimize the time a female might be kept from her pups. Each captured fox was ear-tagged and fitted with a radio collar (Advanced Telemetry Systems Inc., Isanti, MN), weighed, and released. Foxes captured in the spring of 1998 were marked with colored ear-tags, and a unique combination of colored tape on the radio-collar to allow recognition of individuals.

During 1997 we located swift foxes at night using a combination of a roof mounted omni antenna and a hand held "H" antenna. We triangulated from roads traversing the study area, using at least 3 intersecting azimuths per location. The observer's position was determined from USGS 1:24000 scale topographic maps. We estimated home ranges for each pair of foxes in 1997 from telemetry locations, and from the average activity radii of male swift foxes (plus 1 sd)(Pechacek et al. unpublished manuscript). We then delineated the area of each pair's potential home range that did not overlap with the home ranges of adjacent pairs.

We located radio-collared swift foxes at night in 1998 using 2 truck-mounted telemetry towers equipped with 2, 3-element yagi antennas joined with a null / peak box. Each truck was located at a known position and simultaneous bearings were taken from each truck toward a radio-collared fox. We then used the computer program Locate II (vers. 1.3) to triangulate fox locations. With these locations we estimated home ranges for the summer of 1998 using the program Ranges V.

Two test trials were run for 7 days each during the summer of 1997 to estimate the probability of detecting 1 fox from a marked pair, using tracking plates. Transects, 1 km (0.6 mi.) in length and consisting of 4 stations separated by 0.3 km (0.2mi), were placed within or near the core use area of each pair and in the area where overlap with adjacent foxes was absent

or minimal. We purposely avoided areas of overlap with adjacent fox pairs to minimize the number of adult foxes which would likely encounter each transect. Transects were placed in selected locations (e.g., along fencelines, road intersections) to increase the likelihood of fox visitation. Each station consisted of a 61cm x 61cm (2 ft x 2 ft) tracking plate (sheet steel) and an infra-red, remotely triggered camera (TrailMaster TM 1500, Goodson and Assoc. Inc. Lenexa, KS). Each tracking plate was sprayed with a talcum powder-ethanol mixture, leaving a thin coat of talc on the plate, and baited with approximately 5 g of canned mackerel in the center of the plate (Woolley et al. 1995). We started each trial on a day forecasted to be dry because rain would have destroyed the tracking medium (talc). Mackerel was used as an incentive for the foxes to re-visit the plates. Cameras were triggered when an infra-red beam of light centered across the plates was broken, allowing us to identify foxes (radio-collared or non-collared) that visited plates from photographs. If a photograph showed a collared fox, we assumed the fox was one of the pair in whose core area the transect was located. Tracking plates were checked each morning, and swift fox tracks were measured and recorded. Plates were re-baited later that day (early evening). Number of photographs taken each night was recorded, and film was replaced as needed.

The transect / fox pair was the sample unit, and the proportion of transects detecting presence of collared swift foxes during each trial was considered the detection estimate. Because of our small sample size, we estimated a 95% confidence interval by constructing a binomial distribution of theoretical population proportions for each detection estimate (Moore and McCabe 1993).

We ran the same 9 transects in 1998 as we had in 1997 but added 1 additional transect in an area where we now had a fox pair. By running the same transects the second year we hoped

to test the assumption that home ranges will be filled from year to year if the population is not declining. Running the same transects both summers also simulated how we envisioned a monitoring program be run in state-wide application. We determined which of the 1997 transects were still located within a swift fox pair's home range in 1998 and used only these transects to estimate the 1998 detection probabilities.

RESULTS

We captured 41 individual swift foxes between 1996 and 1998 (Appendix A). At the beginning of summer 1997 we had 9 radio-collared pairs (assumed to be breeding associations because they were found together in dens during the breeding and pup-rearing seasons). Five radio-collared foxes died between the first and second detection trials in the summer of 1997, eliminating 1 pair and leaving 3 single foxes. During the summer of 1998, we had 7 pairs radio-collared and 4 single (apparently unmated) foxes.

We ran 9 transects within home ranges of radio-collared swift fox pairs during the first trial in 1997 (27 June - 3 July), and recorded swift fox tracks on 6 transects (66%) after 6 days. We recorded tracks of collared swift foxes on 3 transects during the first 3 days of the trial. Assuming that all tracks left on plates were from collared foxes in whose home range the transect was located, we estimated the probability of detecting at least 1 fox from a marked pair at 0.66. Photographs of collared foxes were taken on 6 of the 9 transects but, tracks were not detected on 3 of these transects. We recorded evidence (tracks, scat found near tracking plates, photographs) that all 9 transects were visited by foxes during the trial. Swift fox scat was detected on or near tracking plates on 4 transects, and photographs of non-collared foxes were recorded on 2 of the transects.

We ran the same 9 transects during the second trial in 1997 (28 August - 3 September), but included only the 8 transects that had at least 1 individual of a pair remaining in the analysis. Tracks of collared (adult) swift foxes were detected on 7 of 8 transects (88%) after 6 days (Table 1). We estimated the probability of detecting at least 1 fox from a marked pair at 0.88 (95% CI = 0.52, 0.99). Photographs of collared swift foxes were taken on all 8 transects. Swift fox scat was detected on or near tracking plates on 5 transects, and photographs of non-collared foxes (presumably young-of-year) were recorded on 6 of the 8 transects.

Table 1. Tracking plate transects detecting swift fox presence during late August 1997 (n=8) and 1998 (n=8) near Medicine Bow, WY.

	Proportion		Days[1]	
Evidence of swift fox presence	1997	1998	1997	1998
Photograph of marked fox and track	0.88	0.63	6	6
Photograph of marked fox with or without track	1.0	0.63	6	6
Track with or without photograph of marked fox	0.88	0.88	6	6
Track or scat[2]	0.88	1.0	6	6
Track, scat[2], or photograph of marked fox	1.0	1.0	6	6

[1] number of transect days required to achieve maximum proportion

[2] swift fox scat found near tracking plate stations

Eight of the 10 transects run in August 1998 (August 20 – 28), were located within the home range of a swift fox pair. Two of the original 1997 transects were on the outer fringes of 1998 home ranges of 2 fox pairs. Because we could not be confident foxes would encounter these 2 transects we excluded them from detection probability estimation. We detected swift fox tracks on 7 of the remaining 8 transects (0.88; 7 of the original 1997 transects and 1 new) after 6 days (Table 1). We did not record photographs of marked foxes on 2 of these 7 transects,

however. We detected swift fox scat on the single transect without a track on day 6 of the trial, resulting in a 100% detection rate from tracks and scat combined. Interestingly, the transect on which we did not detect a swift fox track in 1998 was the same transect on which we did not detect a swift fox track in 1997. The same adult male fox occupied the home range overlapping the transect both summers, although he had a different mate in 1998. We photographed him at a plate in 1997 but not in 1998.

Earlier (Olson et al. 1997) we made the assumption that an area occupied by foxes one year would be occupied by foxes in subsequent years if the population had not declined. This assumption formed the basis for our initial survey design that proposed re-sampling in subsequent years only those transects on which swift fox tracks were detected the first year. In 1998 we detected fox tracks on 6 of the 8 transects that had yielded fox tracks in 1997 suggesting this assumption might not be valid. Although we had 10 pairs of foxes on the study area in 1997 and only 7 in 1998 at the beginning of the summer, numbers of radio-collared foxes present during the August trials were 13 and 17 respectively for the 2 years.

Nine of the 10 home ranges of 1997 swift fox pairs were occupied by foxes in 1998. However, 1 fox pair occupied a home range that had been occupied by 3 pairs in 1997 and we detected at least 1 of these foxes on each of the 3 original transects. Also, 1 swift fox pair (same female, different male in 1998) occupied most of their 1997 range in 1998 but a shift in the home range boundary resulted in the transect being located on the fringe of the home range. We did not detect a fox track on this transect.

DISCUSSION

Based on trial results from 1997 we determined that late summer would be the preferable time to monitor swift foxes (Olson et al. 1997) due to higher detection rates in late summer and

because of the addition of pups to the population. If monitoring is done in late summer (before pups disperse) then presence of pups would also indicate adult fox presence. In 1998 we repeated the trial to obtain a second estimate of detection probability during late summer. We also obtained home range information on swift foxes within the study area to test our assumption about annual home range filling.

The probability of detecting at least 1 fox of a pair using baited tracking plates was 88% both years despite the fact that there was a 70% turnover (only 5 foxes alive in August 1997 were still alive in August 1998) in the population between years. Failure to photograph radio-collared foxes on 2 of the transects in the second year reduced our confidence in the second year estimate but, we often did not photograph a fox that left a track on the plate if it simply stepped on the side of the plate and did not break the infra-red light beam.

Although detection probability estimates were the same both years even with a high turnover in population members, caution should be used in application of this detection probability to statewide surveys. Differing habitat features, such as vegetation and topography, differing population characteristics and differing prey types or densities could influence how foxes respond to tracking plates in other populations. Ideally, similar trials should be run in other populations.

The presence of cameras at tracking plate stations may have affected the detection estimate. Cameras could have conceivably caused either a positive encounter rate effect (foxes may have been curious of the camera and investigated) or a negative detection rate effect (flash may have scared them away before stepping on the tracking plate).

Initially, (Olson et al.1997) we proposed to monitor swift fox population persistence by sampling numerous 1-km transects throughout good quality swift fox habitat within the state.

We chose to use short transects to limit the number of foxes that might be exposed to each transect, thus increasing sensitivity to changes in density. Population monitoring that is not sensitive to density may not be able to detect a significant decline if it occurs. Only those transects detecting foxes in the first year would be monitored for swift fox presence (persistence) in subsequent years. Monitoring only those transects which had swift foxes present initially, would maximize the ability of the monitoring scheme to detect population declines; however, expansion of swift fox populations beyond the initial transects would not be detected. While it might be of interest to detect increases as well as declines, the latter is of greatest need in dealing with sensitive species. Also, monitoring to detect only declines reduces the needed field effort (number of transects). We will use Monte Carlo computer simulations to establish the sample size (# of transects) needed to detect a given level of population decline with a certain degree of statistical power (Beier and Cunningham 1996, Zielinski and Stauffer 1996). Our initial estimates of number of transects required will be based on our estimates of detection error (1-detection probability).

Our test of the assumption that an area occupied by swift foxes one year would be occupied by foxes in subsequent years if the population had not declined in numbers was inconclusive. While the number of pairs of foxes declined from 1997 to 1998 the number of individual adults present was slightly higher in 1998 yet the number of the original 1997 transects with tracks in 1998 was only 6 of 9. And, only 9 of the 10 1997 home ranges of swift fox pairs were occupied by pairs in 1998. Additionally, 3 of the 5 foxes alive during both summers altered their home range use patterns between years, thus changing configuration of their ranges. A transect central within a pair's home range one year might be only peripheral the next and thus be less likely to be encountered. Longer transects may reduce the influence

shifting home ranges would have on the likelihood of transects being encountered from one year to the next. We originally chose the 1 km transect length to minimize the potential number of swift fox home ranges a transect would overlap. On our study area, 1-km transects would overlap an average of 1.23 ranges and 2-km transect, 1.32 home ranges (Olson et al. 1997). Increasing the length of transects from 1 to 2 km would only minimally increase the number of foxes a transect would be exposed to, but should increase the likelihood of it being within at least 1 fox home range (where it could be encountered). The situation we encountered where 1 fox pair in 1998 occupied an area used by 3 pairs in 1997, and the pair visited all 3 transects, would be infrequent in state-wide surveys where transects would be spaced further apart (e.g. 6.4 km, 4 mi.). Spacing between transects during trials was limited by size of our study area and location of the swift fox ranges we targeted.

Interpreting results of the 1997 and 1998 surveys in regard to this technique being able to detect changes in population size on our study area is obviously tenuous but, illustrative of some potential problems in its application. Of the 8 transects with fox tracks in 1997 tracks were detected on only 6 in 1998. The point estimate of 0.88 probability of detection suggested, on average, we should have detected tracks on at least 7 transects if the population had not declined in size, but in fact we had more radio-collared foxes on the study area during August 1998 than August 1997.

MANAGEMENT APPLICATION

The similarity of detection probability estimates between years in a population that had experienced about a 70% turnover is encouraging and supports the initial use of the 0.88 detection probability estimate in survey designs. Our sample size was small both years and trials were conducted in the same population, however. Similar trials should be run in other swift fox

populations to verify this detection level. Not surprisingly, dispersion patterns of foxes on the study area changed from the first to second year, resulting in some transects being located only peripherally in fox ranges the second year, thus influencing their likelihood of being encountered by a fox pair. We recommend increasing transect lengths from 1 to 2 km. Again, based on analyses of data from this population (home range size, configuration and spacing), increasing transect length should reduce the influence of annual variations in fox dispersion while only minimally affecting the survey's sensitivity to change in population size. In fact, longer transects should only help to increase the detection probability because a longer transect will be more likely to be encountered. Spacing of plates and thus number of plates per transect could be changed as well. Typically, more than 1 plate on a transect was visited per night, suggesting that in our population, spacing of plates could have been greater than the 0.3-km spacing we used. Spacing plates at 0.5-km intervals would require 5 plates for a 2-km transect. Transects should be spaced no closer than 6.4 km (4 mi.).

The next step in developing a population monitoring program is to determine the number of transects needed (through computer simulations) to detect a given level of decline. Potential transects within good quality swift fox habitat should be identified and a determination of swift fox presence made. Once an appropriate sized sample of transects with swift foxes present is established they should be monitored annually to detect changes in swift fox persistence. Persistence of foxes on these transects will then be an indicator of population persistence.

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APPENDIX A

Swift foxes captured on the Medicine Bow, Wyoming study site 1996-1998.

Fox #	Initial Capture Date	Fate	Likely Cause	Date died or lost contact
1	09-Mar-96	Mort	Raptor?	July 17 1998
2	09-Mar-96	Mort	?	Nov - Dec 1996
3	11-Mar-96	Mort	?	February 7 1998
4	13-Mar-96	Mort	?	Nov - Dec 1996
5	13-Mar-96	Mort	Badger?	December 20 1997
6	17-Mar-96			
7	18-Mar-96	Mort	?	First week August 97
8	22-Mar-96	Collar failure		End August 97
9	28-Mar-96	Mort	?	First week August 97
10	29-Mar-96	Mort	Coyote	July 2 1997
11	31-Mar-96	Mort	?	July 11 1996
12	31-Mar-96	Mort	?	May 5 1996
13	01-Apr-96	Mort	?	June 2 1996
14	01-Apr-96	Mort	Coyote	May 29 1997
15	02-Apr-96			
16	05-Apr-96	Mort	Coyote	November 17, 1998
17	09-Mar-97	Mort	Coyote	October 13 1997
18	28-Apr-97	Mort	?	Last week July 1997
19	30-Apr-97			
20	08-May-97	Collar failure		November 17 1997
21	16-May-97	Mort	?	Last week July 1997
22	20-May-97	Mort	Coyote	December 10 1997
23	20-May-97	Mort	Coyote	October 5, 1998
24	05-Jun-97	Collar failure		November 17 1997
27	22-Dec-97			
28	22-Dec-97	?		March 8 1998
29	31-Jan-98	Mort	Road kill	End March 1998
30	31-Jan-98	Mort	?	February 7 1998
31	01-Feb-98			
32	07-Feb-98			
33	07-Feb-98			
34	07-Feb-98	?		July 22, 1998
35	06-Mar-98			
36	21-Mar-98			
37	21-Mar-98			
38	10-Apr-98			
39	25-Apr-98			
40	28-Apr-98			
41	05-May-98	?		May 5, 1998
42	05-May-98			
43	05-May-98	Mort	?	End Sept. 1998

Summary of Swift Fox Surveys Conducted on Region 2 National Grasslands in 1998

I. Pawnee National Grasslands - Colorado

A. There were no formal surveys conducted in 1998.

B. There are Swift Fox inhabiting the Pawnee National Grassland.

II. Cimarron National Grasslands - Kansas

A. Formal surveys conducted in 1998. For report see Appendix 1.

B. Swift Fox were found on the Cimarron National Grassland.

III. Commanche National Grasslands - Colorado

A. There were no formal surveys conducted in 1998.

B. There are Swift Fox inhabiting the Commanche National Grassland.

IV. Thunder Basin National Grassland - Wyoming

A. Formal surveys conducted in 1998. For report see Appendix 2.

B. Swift Fox were found on the Thunder Basin National Grassland.

V. Oglala National Grassland - Nebraska

A. There were no formal surveys conducted in 1998.

B. It is questionable wether or not there is a resident Swift Fox population on the Oglala National Grassland. There are Swift Fox north of the Oglala National Grasslands in South Dakota. There has been occasional sightings of Swift Fox on the Oglala National Grasslands but evidence of a resident population has not been found.

VI. Fort Pierre National Grassland - South Dakota

A. There were no formal surveys conducted in 1998.

B. There are no known Swift Fox inhabiting the Fort Pierre National Grassland.

VII. Buffalo Gap National Grasslands - East Half - Wall Ranger District - South Dakota

A. There were no formal Swift Fox surveys done on the Wall Ranger District in 1998. Because Conata Basin is a Black-footed Ferret reintroduction site many hours of spotlighting is being done.

B. Two Swift Fox sightings were recorded during the Black-footed ferret surveys - Pennington County.

1. Dec. 21, 1998 - Section 3, T. 44 N, R. 15 E., Section 34, T. 3 S, R. 15 E. Sighting of a pair of Swift Fox Hunting in a Prairie Dog Colony.

2. Nov. 7, 1998 - Sec. 21, T. 3 S., R. 15 E. Visual 1 Swift Fox in a Prairie Dog Colony.

VIII. Buffalo Gap National Grasslands - West Half - Fall River Ranger District - South Dakota

A. Formal surveys were conducted in 1998. For report see Appendix 3.

B. The Swift Fox population that lives near Ardmore SD appears to be stable. No other Swift Fox were located.

Appendix 1.

SWIFT FOX SURVEY

CIMARRON NATIONAL GRASSLAND, MORTON COUNTY, KANSAS

INTRODUCTION

Across North America, swift fox (*Vulpes velox*) populations showed a dramatic decrease, both in numbers and in the extent of occupied range, from the early 1800s to the mid 1900s (Kahn et al. 1997). This was especially evident in the northern and eastern portion of the species' range. However, beginning in the 1950s, populations began to rebound, re-occupying parts of their historic range (ibid.). Unlike the nationwide trend, the Kansas population has changed little over time, and is currently thought to be stable, occupying much of its historic range. Of 43 Kansas counties considered historic swift fox range, 28 are listed as currently having swift fox (ibid.). However, prior to 1998, there was no documentation nor any data to support the conclusion that Morton County contained swift fox (Christiane Roy, KDWP Mammalogist, pers. comm.).

MORTON COUNTY SWIFT FOX SURVEY HISTORY

To detect the presence of the species on Cimarron National Grassland (CNG), located in Morton County, Forest Service personnel in 1995 conducted a scent-station (n = 12) survey for swift fox. No evidence of the species was found over the ten days of monitoring the stations. In 1997, the Kansas Department of Wildlife and Parks (KDWP) conducted a swift fox survey by systematically sampling alternate townships (n = 278) in 24 western Kansas counties during September and October. Although swift fox evidence was found in 16 counties and 45.0% of the townships, no evidence of swift fox in Morton County was detected. In September, 1998, KDWP resurveyed townships that had failed to detect swift fox in 1997. Ten of the 22 Morton Co. townships resurveyed contained portions of Cimarron National Grassland. Swift fox evidence (tracks) was found in three townships (Table 1). However, the specific locations did not include any portion of CNG, although one location was < 1/8 mile from CNG.

Table 1. Morton County Locations with Swift Fox Evidence (1998 KDWP Survey)

TOWNSHIP: (Section, Township, Range)

Section 35, Township 32 South, Range 43 West

Section 24, Township 32 South, Range 43 West

Section 35/36, Township 35 South, Range 39 West

By coincidence, Cimarron National Grassland had decided to conduct a spot-light survey for swift fox in September, 1998. The CNG survey occurred shortly after the KDWP resurvey of Morton County. The results of the CNG survey are given in this report.

SURVEY AREA

The 108,000 acres of Cimarron National Grassland is classified as semi-arid prairie. Average annual rainfall is 16 inches, usually occurring as summer thunderstorms. Average annual temperature is 56 degrees F, with summer highs of 100+ degrees and winter lows in the 20's. The terrain is generally flat to gently rolling with three distinct habitats: shortgrass prairie, riparian, and sandsage prairie. The riparian habitat follows the course of the Cimarron River, containing mostly cottonwoods (*Populus deltoides*) and tamarisk (*Tamarix gallica*), with an understory of grasses and forbs. North of the riparian zone is shortgrass prairie, with buffalograss (*Buchloe dactyloides*), side-oats grama (*Bouteloua curtipendula*), and blue grama (*Bouteloua gracilis*) dominating. There are scattered patches of sandsage (*Artemisia filifolia*) and soapweed (*Yucca glauca*). The soils are mostly clay and clay-loam. South of the riparian zone is sandsage prairie, with sandsage and midgrass species dominating. Soils here are mostly sand to sandy-loam. Because the sandy soils of the sandsage habitat would not support den construction, and due to factors better addressed in other previously published papers, swift fox are believed to occur primarily in the shortgrass prairie habitat on CNG.

SURVEY METHOD

On September 15 and 16, 1998, Kevin Kaczmareck, Forest Service Biologist, Jeff Chynoweth, Forest Service Biologist, and Dave Walstrom, Forest Service Technician, conducted a spotlight survey for swift fox. Based on KDWP resurvey swift fox locations (Table 1), and on swift fox habitat parameters (K. Kintigh, Swift Fox Researcher, pers. comm.), we concentrated our efforts on isolated CNG pastures with shortgrass prairie. Although our primary goal was to detect the species on CNG, the grassland in this area is highly fragmented with large sections of private land interspersed with CNG land. Because of this landscape mosaic, we surveyed both private and public land, although at different intensities.

On both nights, spotlighting started approximately 45 minutes to an hour after sunset (start times: 9/15 - 2100; 9/16 - 2045). Two spotlights were used. Within CNG property, we slowly drove transects,

approximately 1/4 mile apart, until an eye shine was spotted. Preliminary species identification was done using binoculars. In most instances, the individual was a lagomorph, either a cottontail (*Sylvilagus* sp.) or black-tailed jackrabbit (*Lepus californicus*). If the eye shine was a canid species (or was suspected to be), or could not be identified to species at first shine, we attempted to get close enough to the animal by driving to the spot of eye shine while trying to keep at least one light on the individual. Once there, we'd stop and attempt to relocate the animal by sweeping the area with the lights. Eventually, the individual was either identified or lost in the night. After each chase, we'd return to running transects until the entire area had been surveyed.

Driving between CNG properties, we would spotlight agricultural fields looking for reflections. However, unlike eye shines seen on CNG property, those on private land were not chased. If the individual could not be positively identified from the road, we marked it as an unknown, and continued driving/spotlighting to the next CNG property (Table 2. Survey Totals).

Table 2. Survey Totals (time, miles, and acres)

NIGHT	TIME	MILES	ACRES *
9/15/98	4 hrs	44.6	2,640
9/16/98	5 hrs	60.3	3,280
Totals	9 hrs	100.9	5,900

SURVEY RESULTS

The survey resulted in four swift fox sightings over two nights of surveying; three individuals on lands administered by CNG, and one individual on private land (Table 3). These locations were different than those from the KDWP resurvey (Table 1).

Table 3. Swift Fox Locations from 1998 Cimarron National Grassland Survey

TOWNSHIP: (Section, Township, Range)
Section 6, Township 32 South, Range 43 West *
Section 18, Township 33 South, Range 43 West **
Section 16, Township 33 South, Range 42 West ***

* - one individual on CNG property

** - one individual on private land

*** - two individuals on CNG property

SEPTEMBER 15/16, 1998

The first swift fox was seen on CNG pasture 47 (Section 6, Township 32 South, Range 43 West) at approximately 2145 hours. The animal was about 300 yards from the truck. Based on the size relationship between the animal and the surrounding prairie dog mounds nearby, the canid appeared to be smaller than a coyote. The pelage was two toned - gray on the back with tan sides and legs. The tail was bushy, but a black tip was not noted. We glassed the animal for perhaps ten seconds before it disappeared (possibly into a den/prairie dog hole). After intensively searching the area, the animal was not seen again at the time. We continued our survey of pasture 47, later returning to the original sighting locale to attempt to relocate the animal. We spotted a small canid in the same general location, but, it quickly disappeared without being glassed. Again, intensive searching failed to relocate the animal. Several adult coyotes were also seen in the same vicinity as the swift fox.

The second and third foxes were both seen in the Greenwood pasture (Section 16, Township 33 South, Range 42 West) between 2300 and 0030 hours. Fox #2 was spotted approximately 100 yards from the vehicle, chased for confirmation, and eventually disappeared into a large patch of weeds. We were within 20 feet of the animal before it disappeared. The pelage was again gray and tan, with a black-tipped tail. The size was about that of a large house cat.

The third fox was found about 1/4 mile NW from fox #2's location. We chased the animal for several hundred yards before it was lost in the grass. During the chase, patches of taller grasses hid most of the animal from direct view. However, the animal's small size and several clear views of its back and tail showed it to be a swift fox. Five minutes after losing the fox, we relocated it laying on a prairie dog town approximately 1/8 mile away within clear view. A fence between us and the fox deterred our ability to get closer at that time. After we arrived at the prairie dog town, we spotted a swift fox (same?) only briefly before it disappeared.

While completing the Greenwood pasture survey, we spotted several other canid eye shines, but were unable to confirm all to species. Several adult coyotes and a skunk were seen in Greenwood pasture.

SEPTEMBER 16/17, 1998

At approximately 0145 hours, Kaczmarek spotted eye shine from two animals in a recently plowed millot/wheat field (Section 18, Township 33 South, Range 43 West). One of the eye shines belonged to

a badger, but the second was that of a swift fox. The animal was in clear view approximately 200 to 300 yards from the vehicle, rapidly traveling westward. (The Kansas-Colorado stateline is one mile west of the sighting location). Because the animal was on private land we did not attempt to chase it nor was there any need to. We watched the fox for approximately 2-3 minutes before we left. The authors urge caution in stating that fox #4 was a different animal than fox #1. In a study of swift fox home range size conducted at the Pinon Canyon Maneuver Site in Colorado, home ranges varied from 12.8 km^2 (4.6 mi^2) to 34.3 km^2 (13.4 mi^2). The 4.0 km (2.5 mile) distance between fox #1 and fox #4 was clearly within the potential home range of fox #1. Therefore, the authors are simply stating that a different sighting of a swift fox was made on September 16/17.

CONCLUSION

Both the KDWP and CNG surveys show that swift fox do occur within Morton County and on CNG. One of the major causes of fox mortality is road-kills (Kahn et al. 1997). The lack of reported road-killed swift fox in Morton County may indicate that although there are swift fox within the county, the population is probably small. However, this needs clarification. The next step therefore should be a thorough survey of potential swift fox habitat within Morton County and on CNG, to determine the species' population status and distribution.

REFERENCES CITED

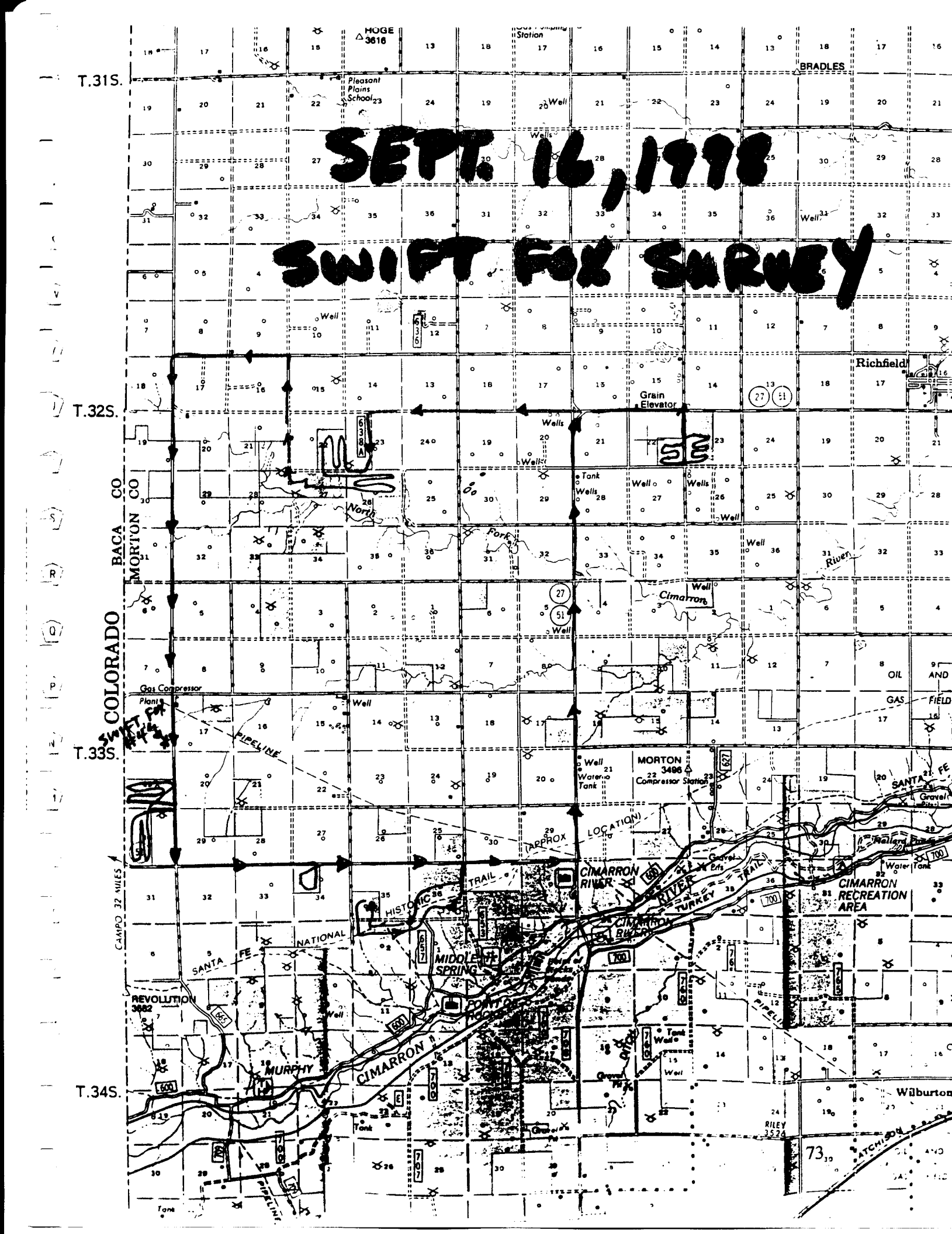
Hahn, Rick, et al. 1997. Conservation Assessment and Conservation Strategy for Swift Fox in the United States. Swift Fox Conservation Team, 1994 and 1995 meeting notes.

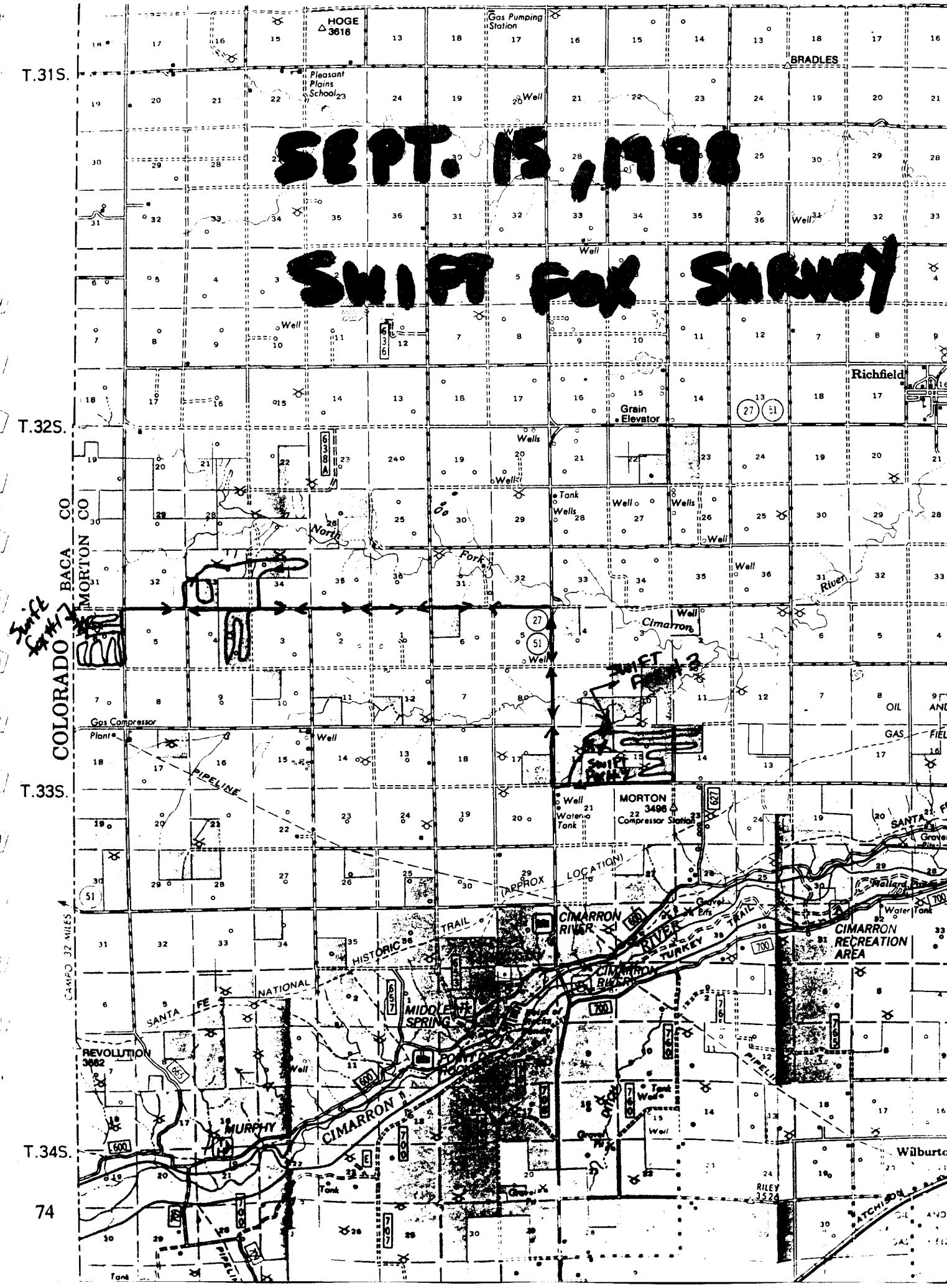
Submitted by Jeff Chynoweth*, Kevin Kaczmarek**, and Dave Walstrom**

September 18, 1998

* Cimarron National Grassland, Elkhart, Kansas

** Comanche National Grassland, Springfield, Colorado


SEPT. 16, 1998
SWIFT FOX SURVEY
T.31S.
T.32S.
T.33S.
T.34S.
COLORADO
BACA CO
MORTON CO
HOGE 3616
BRADLES
Pleasant Plains School
Richfield
Grain Elevator
Cimarron
MORTON 3496
Compressor Station
Gas Compressor Plants
PIPELINE
CIMARRON RIVER
CIMARRON RECREATION AREA
HISTORIC SANTA FE TRAIL
NATIONAL
MIDDLE SPRING
REVOLUTION 3662
MURPHY
CIMARRON
RILEY 3526
Wilburton
CAMPO 32 MILES
APPROX LOCATION
OIL AND GAS FIELD


SEPT. 15, 1998
SWIFT FOX SURVEY
T.31S.
T.32S.
T.33S.
T.34S.
COLORADO
BACA CO
MORTON CO
MORTON COUNTY ROAD NUMBERS
HOGE
3616
Gas Pumping Station
BRADLES
Pleasant Plains School
Richfield
Grain Elevator
North Fork
Cimarron River
Gas Compressor Plant
PIPELINE
MORTON
3496
Compressor Station
Water Tank
LOCATION)
(APPROX
CIMARRON RIVER
CIMARRON RECREATION AREA
HISTORIC SANTA FE TRAIL
NATIONAL
MIDDLE SPRING
REVOLUTION
3662
MURPHY
CIMARRON
RILEY
3526
CAMPO 32 MILES
Swift Fox #1
Swift Fox #2
Swift Fox #3

1998 SWIFT FOX SURVEY

THUNDER BASIN NATIONAL GRASSLAND

DOUGLAS RANGER DISTRICT

INTRODUCTION

Historically, the Swift fox (Vulpes velox) was found throughout mixed and short-grass prairie regions of the Great Plains, from Canada to Mexico. Current distribution is in nine states (Montana to Texas) and three Canadian provinces (Saskatchewan, Alberta and Manitoba). This species is listed by each state's wildlife agency as follows:

Montana: Furbearer-closed season

North Dakota: Furbearer -closed season

South Dakota: Threatened

Wyoming: Nongame, Species of Special Concern (SSC3)

Nebraska: Endangered

Colorado and Oaklahoma: Furbearer- closed season

Kansas, New Mexico and Texas: Furbearer -open season

NOTE: all above information was obtained through personal communication with Robert Hodorff, Fall River Ranger District, Nebraska National Forest (01/09/97).

In the three Canadian provinces, Swift fox status is identified as:

Saskatchewan and Alberta: occurring within the historic species range.

Manitoba: Endangered.

NOTE: this information was obtained from a document organized by John Sidle, "Matrix of listed species in the Great Plains".

Based on 1995 survey data, in Wyoming, the Swift fox has been found in Laramie, Albany, Converse, Fremont, Goshen, Natrona, Sweetwater, and Weston counties. Regionally, the Forest Service considers the Swift fox as a Region 2 Sensitive species. The Fish and Widlife Service (USFWS), under the Endangered Species Act (ESA-1973) considers that listing this species is *warrented but precluded* by other higher priority actions for listing; therefore this species is designated as a *candidate* species.

Objective of our survey was to determine presence or absence of Swift fox in areas proposed for Coal Bed Methane development, on and near Thunder Basin National Grassland (TBNG) and associated with Bureau of Land Management (BLM) surface or subsurface minerals ownership.

METHODS

Techniques and methods used to conduct these surveys were developed at the Wyoming Cooperative Fish and Wildlife Research Unit by Tim Woolley and Frederick Lindzey. Survey transects were run in Right Of Ways (ROW) *along public access roads* thru private, BLM, TBNG, and state lands. Each

survey transect was run for three (3) consecutive nights. Transects were 30 miles long and tracking plates were placed at one (1) mile intervals in ROWs. Tracking plate medium used was a rubbing alcohol/talc mixture. Surveys were conducted from August 25 thru September 17, 1998 by one to two technicians (one person per route). Suspected swift fox tracks were photographed on the tracking plate and also "lifted" off the plate using clear tape. Locations of survey plates were documented (in latitude and longitude) using a Global Positioning System (GPS) unit and detailed notes.

RESULTS

A **total** of **five survey transects** were run in ROWs along public access roads thru BLM, NG, private and state lands. Each survey transect inventoried 1,920 acres; for a **total inventory of 9,600 acres**. Suspeted swift fox tracks were discovered on various tracking plates during all survey routes. Please see *Appendix 1* which documents latitudes and longitudes of the locations of tracking plates where suspected swift fox tracks were discovered.

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Luce, B., B. Oakleaf, A. Cerovski, L.Hunter, and J. Priday. November 1997. Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming. Wyoming Game and Fish Department.

Sidle, John. "Matrix" of Listed Species in the Great Plains. July 1996.

Woolley, T., F. Lindzey, and R. Rothwell. Swift fox Surveys in Wyoming. December 1995. Cooperative Fish and Wildlife Research Unit and Wyoming Game and Fish Department.

Wyoming Game and Fish Department. Executive Summary of the Conservation Strategy for the Swift fox. December 1995.

APPENDIX I

Survey route numbers/names and latitude/longitude locations of tracking plateson ***which SUSPECTED swift fox tracks were found.***

Route #1: Hilight, Wagenson, and Breene Roads

Swift fox tracks were found on 08/27/98 on:

Plate #13 N 43 51' 12.87" W 105 23' 06.64"

Route #2: Cosner, S.Clarkelen, Todd, and Moore Roads

Swift fox tracks were found on 09/01/98 on:

Plate #4 N 43 40' 18.07" W 105 31' 36.36"

Plate #5 N 43 40' 19.05" W 105 32' 49.89"

Plate #22 N 43 42' 16.51" W 105 41' 10.31"

Plate #29 N 43 45' 14.02" W 105 43' 25.16"

Swift fox tracks were found on 09/02/98 on:

Plate #1 N43 40' 35.36" W 105 28' 13.17"

Plate #5 N43 40' 19.05" W 105 32' 49.89"

Plate #6 N 43 40' 15.32" W 105 33' 55.30"

Plate #17 N 43 40' 44.47" W 105 42' 37.19"

Plate #18 N 43 40' 40.63" W 105 43' 43.38"

Plate #23 N 43 43' 09.13" W 105 41' 10.04"

Swift fox tracks were found on 09/03/98 on:

Plate #23 N 43 43' 09.13" W 105 41' 10.04"

Plate #24 N 43 44' 03.04" W 105 41' 08.50"

Route # 3: Clarkelen and Savageton Roads:

Swift fox tracks were found on 09/10/98 on:

Plate #21 N 43 59' 06.76" W 105 39' 57.66"

Swift fox tracks were found on 09/11/98 on:

Plate #20 N 43 58' 14.66" W 105 38' 55.13"

Plate #29 N 44 05' 52.12" W 105 38' 58.23"

Swift fox tracks were found on 09/12/98 on:

Plate #27 N 44 04' 10.58" W 105 38' 59.85"

APPENDIX I continued

Route # 4: Napier, Barber and Barlow Roads

Swift fox tracks were found on 09/15/98 on:

Plate #4 N 44 04' 17.14" W 105 46' 36.92"

Swift fox tracks were found on 09/17/98 on:

Plate #5 N 44 03' 38.35" W 105 46' 50.90"

Route # 5: Kingsbury, Montgomery and Echeta Roads

Swift fox tracks were found on 09/16/98 on:

Plate #1 N 44 12' 31.92" W 105 50' 50.14"

Plate #4 N 44 15' 01.92" W 105 50' 22.83"

Swift fox tracks were found on 09/17/98 on:

Plate #14 N 44 16' 34.95" W 105 41' 33.30"

1998 SWIFT FOX SURVEY

FALL RIVER RANGER DISTRICT
BUFFALO GAP NATIONAL GRASSLAND
NEBRASKA NATIONAL FOREST
LYNN ALLAN HETLET

INTRODUCTION

Surveys to determine locations of swift fox (*Vulpes velox*) were conducted on the Fall River District of the Buffalo Gap National Grassland from 1989 through 1997. Additional new areas were surveyed in 1998, as well as the only annual route established in 1994 that still shows evidence of a swift fox population.

SURVEY AREAS

The areas of Fall River County previously unsurveyed for swift fox that were surveyed in 1998 totaled 5,120 acres (Maps 1,2). The established annual route surveyed 2,720 acres (Map 3).

METHODS

Approximately 120 man-hours (including travel time) were spent establishing and utilizing bait stations. A bait station consists of a circular area 18 to 20 inches in diameter cleared of all vegetation. A mixture of fine masonry sand and vegetable oil is then spread over the circle and smoothed. The mixture consists of one cup of oil to one gallon of sand.

Approximately one-half ounce of jack mackerel was placed in the center of the station to serve as bait. Because of the swift fox's primarily nocturnal habits, the stations were baited during the early evening hours.

This sand/oil mixture will hold a track impression quite well, and if insects such as grasshoppers and carrion beetles are not abundant enough to be disturbing the bait and sand, (through either digging or simply hopping through it), it is not necessary to check the sites early, but the slanting light of the early hours greatly facilitates in seeing details in the track.

Bait stations are placed approximately 1/4 mile apart on ridge tops to give better scent dispersal on the evening downdrafts.

RESULTS AND DISCUSSION

The area newly surveyed in the Oelrichs area (Map 1) resulted in only one track--an indistinct probable red fox (*Vulpes vulpes*) track-- from a total of 30 bait stations. The newly surveyed area in the French Creek area had tracks from cottontails at one station, striped skunks at one station, and American badgers at two stations, from a total of 26 stations (Table 2).

The annual survey in the Ardmore area (Map 3) resulted in tracks at 34 bait stations over the three nights, out of a possible 93 bait station-nights (Table 1). This is up from only 12 in 1997, but still down from the 45-50 for each of the 3 previous years. Only one track was found in the south half of the survey area (similar to 1997), indicating to me that that area is no longer used for denning.

One active den was located (Map 3), with three foxes seen at the den. All three appeared to be adults. If this is the case, it could indicate the possibility of extended family care of the kits. Another indication of this came from Carmen Blumberg (personal communication), who, in 1991, saw an uncollared adult female swift fox leave a den known to have kits and a collared lactating female.

Bait Station	Day 1	Day 2	Day 3
1		CALA	
2			
3			
4			
5		SPSP	
6			
7		CALA	
8	VUVE		
9			
10			
11			
12			
13			
14			
15		CALA	
16		CALA	
17			
18			
19	CALA	VUVE	VUVE
20			VUVE
21	VUVE	VUVE	VUVE
22	VUVE	VUVE	VUVE
23	VUVE	VUVE	VUVE
24	VUVE		
25	VUVE	VUVE	VUVE
26	VUVE	VUVE	VUVE
27	VUVE	VUVE	VUVE
28	VUVE	VUVE	VUVE
29	VUVE	VUVE	VUVE
30	VUVE	VUVE	VUVE
31	VUVE	VUVE	

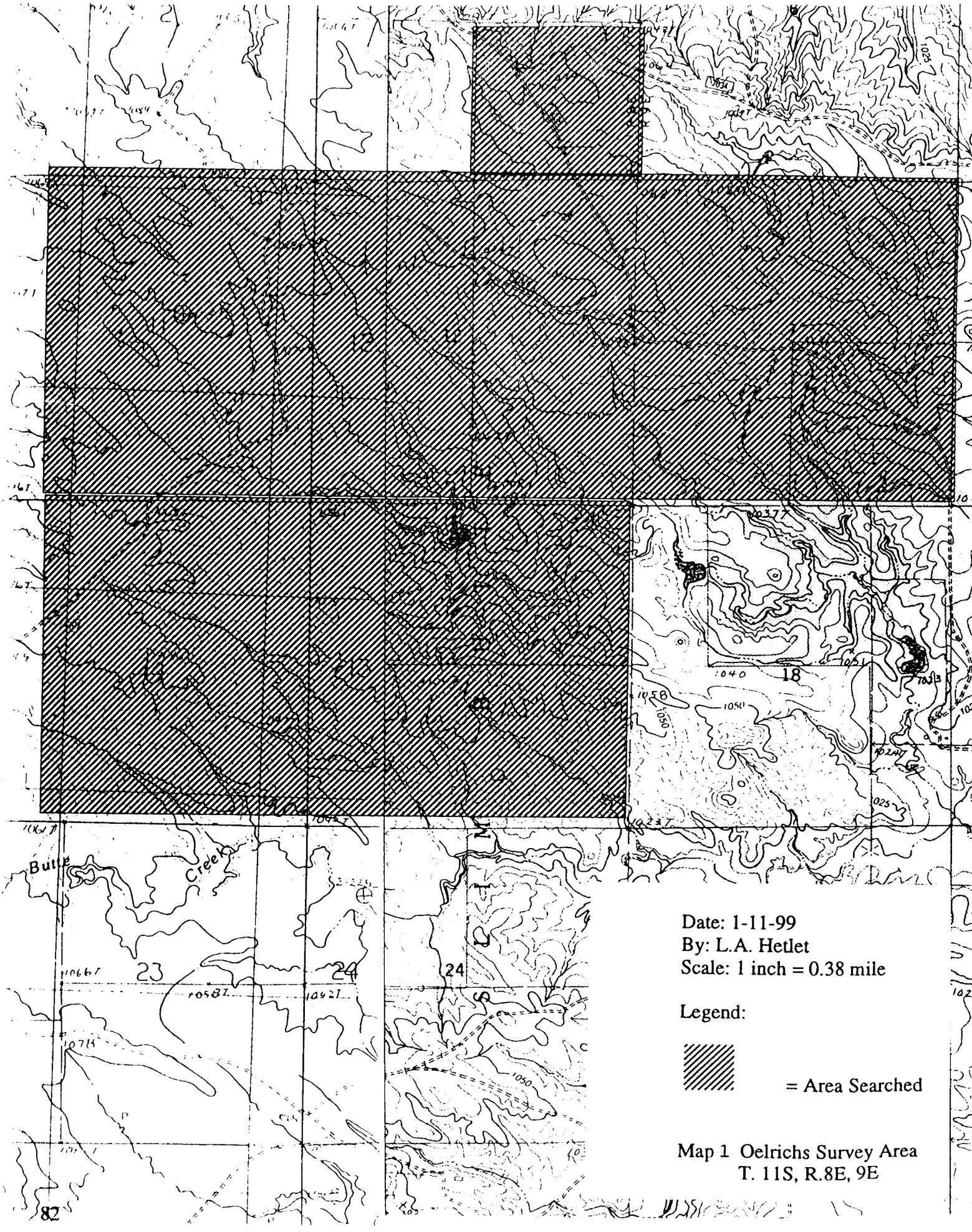
Table 1. Track on Ardmore Area swift fox survey route (Map 1) August 12, 13, 14, 1998.

VUVE - swift fox
CALA - coyote

Bait Station	Day 1	Day 2	Day 3
1	SPSP		
2			
3			
4			
5			
6			
7			
8	MEME		
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23	TATA		
24			
25			
26			TATA

Table 2. Tracks on French Creek survey area (Map 2) August 25, 26, 27, 1988.

MEME - striped skunk
TATA - American badger
SPSP - cottontail species

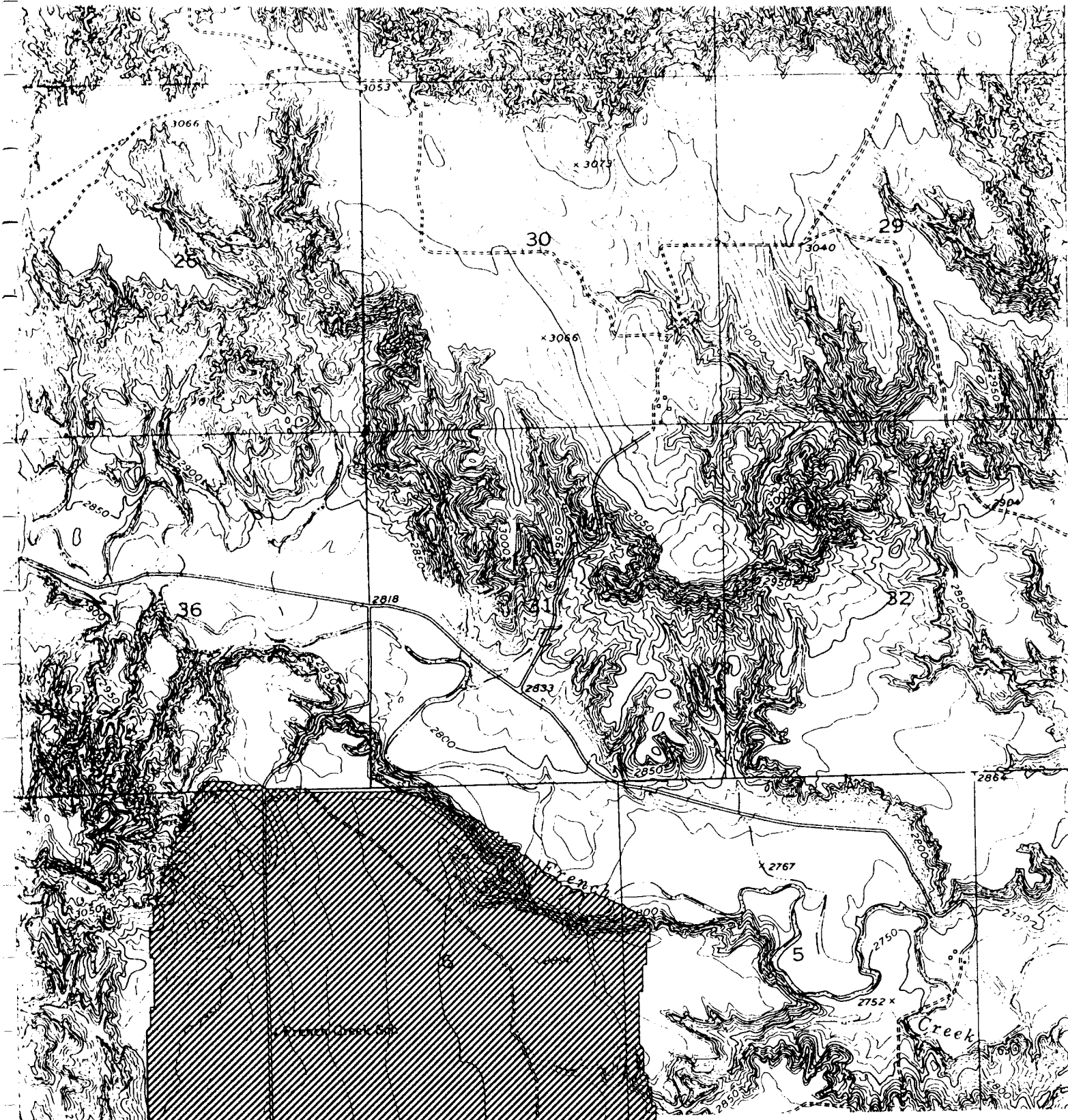


Date: 1-11-99
By: L.A. Hetlet
Scale: 1 inch = 0.38 mile

Legend:

= Area Searched

Map 1 Oelrichs Survey Area
T. 11S, R.8E, 9E

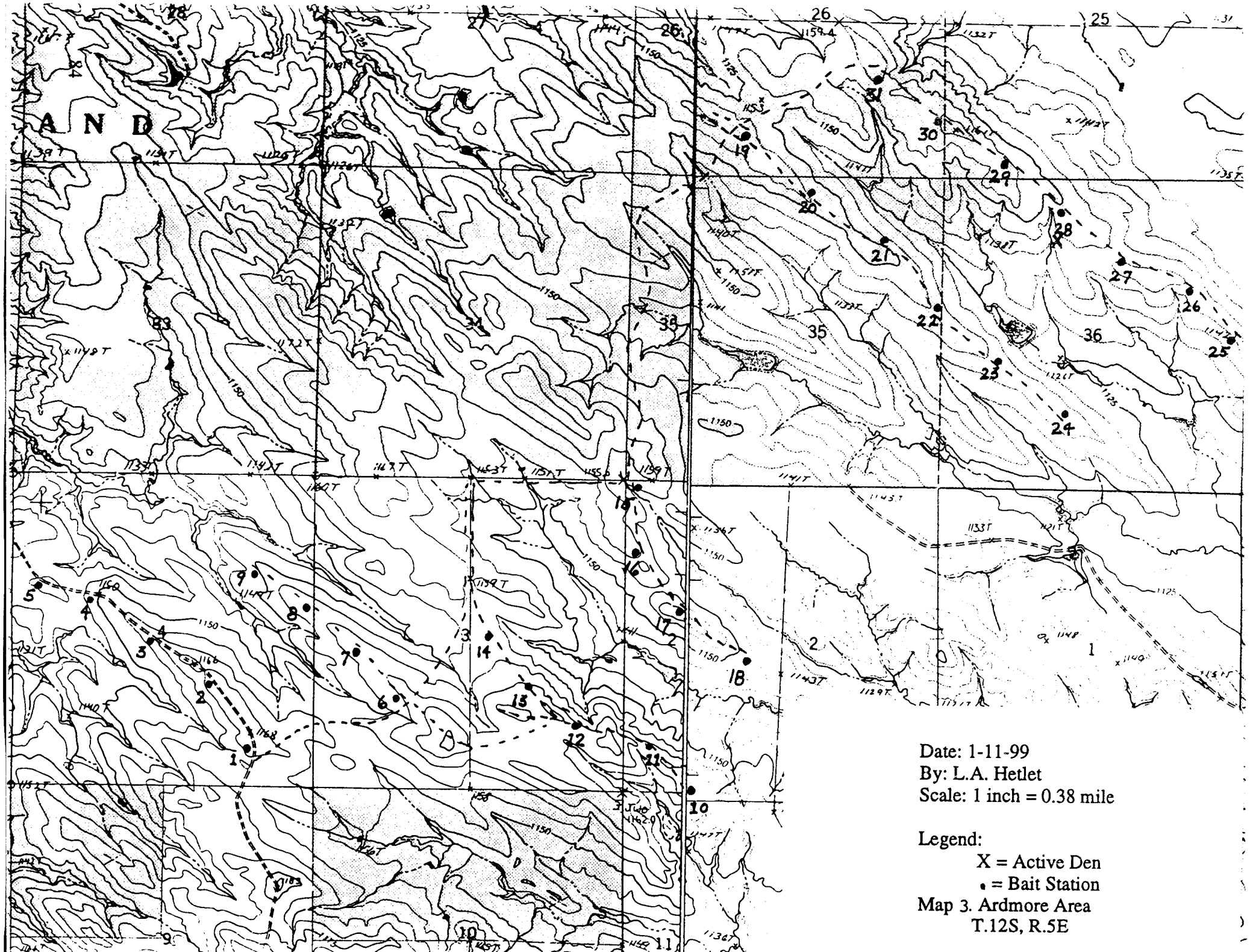


Date: 1-11-99
By: L.A. Hetlet
Scale: 1 inch = 0.38 mile

Legend:

= Area Searched

Map 2. French Creek Survey Area
T.5s, R. 9E,10E



Date: 1-11-99
By: L.A. Hetlet
Scale: 1 inch = 0.38 mile

Legend:

X = Active Den

• = Bait Station

Map 3. Ardmore Area
T.12S, R.5E

Annual Swift Fox Conservation Team Meeting
December 8, 1998
Amarillo, Texas

I. Introduction

Each participant stated their name and affiliation, see the meeting participants list (Appendix I) for all participants. Eileen stated that Brian Giddings (MT) was unfortunately unable to make the meeting but did put together a handout on what he knew about the Defenders of Wildlife-sponsored swift fox reintroduction in Montana.

II. Reevaluation of the Federal Status for the U.S. Swift Fox

Both Pete Gober and Dave Allardyce discussed the revised annual candidate assessment the swift fox. Pete began discussions by emphasizing that despite the draft candidate assessment written by Dave, the final decision to remove the fox from the candidate list is up to Director of the USFWS. Pete wanted everyone to understand the tentative nature of these discussions and to not presume that the swift fox would be removed from the candidate list automatically.

Dave echoed Pete's cautions to the group. He then went through a chronology of his efforts to re-evaluate the status of the swift fox. Dave stated that he had begun work on his recommendation in July, and made a preliminary submission to the Regional office. He stated that he just received notice from the Washington office (Director of USFWS Division of Candidate Species) that they will require a federal register notice; he is currently working on that notice also. A revised administrative finding will be necessary as well. In that regard, he requested comments from the Team on his proposal so that it can be the best product possible. The current proposal is a tentative draft and contains only Dave's thoughts so he will forward it on to others and is very interested in comments from the Team. He said that he would like comments as soon as possible, definitely by mid- to late-January. The draft will go through extensive peer review and will also be signed by Region 2. He speculated that it would be well after January before Washington gets the report, but emphasized again that he wants comments as soon as possible. The agency is anticipating sensitivity to the recommendation and the related issues, therefore it needs ample background why the decision was made. Dave mentioned that he is moving forward as fast as he can, though emphasized that they do anticipate that the agency will be sued for its decision.

Dave also took the opportunity to comment on his dealings with the Team. He said that he has been genuinely pleased with the Team and that the biologists have been a treat to work with. He stressed that he appreciated the candor and attention to detail. That candor and attention to detail produced the CACS which will be the greatest asset to making the final determination. He is thankful for the Team's efforts to date and hopes that they can follow-through to finish up the process.

Pete and Dave clarified that when a candidate species is removed from the list, it also means that a listing as threatened is not warranted. Dave said that in the new notice in register he intends to include that the original petition was endangered and that his recommendation will be that listing of any type (threatened or endangered) is not warranted.

Pete emphasized that the state biologists had a good feeling that foxes were out there, unfortunately they just didn't have the information originally. He stated that now, because of the extensive efforts by the Team, the data are there. If foxes had not been found, the case would have been much different and tougher. He said that people will be watching and that he hoped that the Team's activities will continue. Dave and Pete further explained that the warranted but precluded listing gave the states an opportunity to get the needed data and to document population trends.

Dave clarified that the new finding and new federal register notice will contain information from the proposal packet. He mentioned that the regional office may want more data. If so, that data would also be included and a population viability analysis may be needed.

If the agency gets sued, Pete and Dave anticipate that the petitioners will challenge the recommendation biologically. They stated that intuitively the data have demonstrated population viability; however this analysis is not refined. Given the fact that the swift fox persists at low densities and is a wide-spread species, they think they can deal with the issue but will no doubt get beat up in the process.

Axel asked about the time-scale that the agency was working under to assess population viability. Dave and Pete stated that the recovery objective stated in the CACS was to restore the fox to 50% of its range. They both admitted that this was difficult to address on a national level but posed that maybe it could be addressed on a state-by-state level.

It was mentioned that many times it is harder to get the money to do the work than to do the work itself.

Given the fact that petitioners could challenge the findings or petition to list the species again, several attendees asked what can the state agency biologists should do in the interim. Dave and Pete emphasized that the Team needed to keep up the momentum related to swift fox activities and continue its meetings. Dave also mentioned that the criteria to look at new petitions or re-circulated ones have been strengthened and that the standard will be much higher. In other words, the petitioner will have to have their ducks in a line. Also, USFWS will have to make a decision based on the information at hand. Therefore, the Team can help by providing material to make the upcoming report the most valid one possible.

Eileen thanked Dave for his efforts and let him know that he is very much considered a part of the Team and sincerely acknowledged his and USFWS efforts on their behalf.

III. Conservation Education

SFCT Newsletter

Julianne asked the Team about the pros and cons of continuing the SFCT Newsletter that had been distributed to each state representative. Several Team members mentioned that the effort wasn't really going anywhere. Kevin mentioned that even though the lesser prairie chicken newsletter went to over 30,000 people, they received less than a 1% return rate (less than 1% of the individuals who were mailed a lesser prairie chicken newsletter returned the questionnaire.) Several Team members mentioned that the public education effort is good even if individuals do not return the survey. Several Team representatives cited the cost and effort involved as reasons that their state had not been able to produce the newsletter. Several group members felt that it was important to continue the newsletter to raise awareness, unless state agencies were not going to be able to distribute them. It was suggested that there may be a greater response from private landowners if the fox was not listed, and thus the newsletter could be used to obtain additional sighting information. One way to increase the dissemination rate was to possibly use the NRCS or county offices to send the newsletters out, though it was emphasized that could take a sales job to have the offices take on the responsibility.

Pete suggested that the states work on a press release to update interested parties on the status of the fox. He stressed that for the press release to be effective, it was important that it contained accurate information, e.g. don't say that the species is out of the woods yet.

The general consensus of the group regarding the newsletter was that, yes, the Team is committed to do another issue. Given the upcoming finding, the Team suggested that they delay the next newsletter until USFWS's ruling is out. Dave and Pete emphasized that it won't be any

easier getting out than it was getting in and that it may take at least 6 months to 1 year to get comments. When asked about the priority of the ruling in the service, Dave explained that it was a tier 2 level. The service has an obligation to finish up within this fiscal year and that the regional level may be a hold up, though it is unlikely given the pressure to see the project through. They anticipate an April or May Federal Register notice.

Zoo-Based Conservation Efforts
Tarren and Mike discussed the zoo-based efforts in the past year related to swift fox conservation. Appendix II is the handout given to Team members at the meeting which outlines the Swift Fox Captive Conservation Program focus and activities to date (conservation education, field conservation, research/development of technology, captive programs and exhibition).

Other Education Activities
Christiane mentioned that Kansas has a video on the short grass prairie ecosystem. Axel mentioned that there is an endangered grassland species video which is included in the high school curriculum in Canada. Contact either Christiane or Axel for a copy of either video.

IV. U.S. Swift Fox Reintroductions
Eileen mentioned that since he couldn't attend the meeting, Brian Giddings submitted a document to the Team outlining what he knew of the swift fox reintroduction in Montana. He also requested further discussion on the standardized methodology issue.

The group first discussed the Montana reintroduction. Concern was expressed over the fact that few representatives were aware of the reintroduction and its intent. It was emphasized that whether the Team determines that this specific reintroduction was good or not, it could happen again and that if the Team waits until they are comfortable with the genetics issues, other groups may even get involved in the reintroductions. It was therefore recommended that the Team come up with guidelines regarding the reintroduction of the U.S. swift fox.

Lu mentioned that the IUCN does have a general set of guidelines that deals with source stock, genetics and the process itself that could be adopted for the swift fox program. He stated that it is a universal statement so it would need to be put into a local perspective. Pete suggested that given the number of states involved, the Team should recommend very specific specifications on releases.

Discussion turned to the specifics of the Montana release. Several representatives questioned the permit process of the reintroduction and translocations in general. It was mentioned that the process to get foxes from WY to Canada was extreme and involved three levels of permitting. In the Montana release, the argument may have been that foxes were already coming into Montana through the Canadian reintroduction program. It was noted that the foxes for this reintroduction came from Cochrane Ecological Institute. Concern was expressed by several representatives about the potential of the introduction of disease to wild foxes, specifically from a captive facility which could be disastrous. Furthermore, the Canadian program is monitored extensively and foxes from the reintroduced population in the U.S. may overlap with the Canadian population. This could confuse the monitoring efforts since the researchers wanted to monitor the success there without additional releases in the area.

Depending on the situation (US-Canada or state-state), USFWS may come inspect the shipment, in others it is just an interstate transfer. Indian reservations are also a different situation. Given all the questions related to the reintroduction, permitting requirements etc., both Pete and Dave volunteered that they would investigate the transactions. It was noted that Brian was not originally part of the working group that coordinated the MT reintroduction effort.

Regarding the larger reintroduction issue, the group asked whether they should establish a policy statement regarding reintroductions. It was recommended that since the Team has members that represent the states that would potentially be involved, the Team should go on record that reintroductions should not be carried out unless properly communicated and screened by the Team. One mechanism to assure screening would be to suggest that USDA inspectors at the border keep foxes from crossing the border until the reintroduction plan has been screened by the Team.

Discussions continued on the merits of reintroductions at this point at all. Several team members expressed concern over releasing foxes into areas where there are already foxes. In other areas, we may not know if there are foxes in a given area at all. For those reasons, several members were against any release at this point. Others suggested that if a reintroduction is proposed in an area that has been surveyed, and biologists know how many foxes are there, then establish specific guidelines. Kevin agreed that at this point, there are too many gaps in our knowledge related to reintroductions to release animals into unknown situations and therefore he was against reintroduction in general. If in specific, rare instances a reintroduction may be warranted, then he suggested that biologists follow the recommendations established by the Team.

Lu suggested that reintroduction can be a valuable tool for the conservation of a species though it needs to be managed using the best possible options. Lu suggested that the Team does not get into the issue lightly. Every state except for ND has fox, and he wonders whether everyone is convinced that there aren't swift fox there. It's possible that counties marked as being populated by foxes, when a closer scrutiny may reveal that the evidence was circumstantial and questionable. Lu does not like evidence based on tracks alone. Hard evidence needs to be obtained from spot lighting, trapping and road kills, however, some road kills reported as swift fox in Alberta turned out to be coyote pups. Lu also recommended that hard vs. soft reintroduction methods should be chosen based on each given situation. The recommendations need to be helpful rather than policing in that sense.

Several Team members mentioned that swift fox population expansion (via translocations of wild fox) is what may be needed rather than true reintroductions. However, given the current situation, the SFCT needs to put into place a good set of recommendations that needs to be widely distributed. Hopefully, the peer pressure will bring folks to the table. It was recommended that the resolution include: reintroductions are not warranted at this time, if they must be considered for a special circumstance, then follow the SFCT recommendations and seek the group's sanction. It was also recommended that if considered, reintroductions should maintain natural corridors.

The recommendation was made to establish a committee to establish a Team policy statement on reintroductions. This reintroduction committee would start with the IUCN guidelines and provide suggested modifications to account for state-by-state policies. It was further recommended that the Team policy be that it does not support the reintroduction of swift fox in general at this point. If it is being considered for a specific case, then the interested party should contact the Team to get recommendations before proceeding. The following individuals volunteered to contribute to this subgroup: Lu Carbyn, Axel Moehrenschlager, Eileen Dowd Stukel, Marsha Sovada, Dave Allardyce, Mike Fouraker and Tarren Wagener. The committee will put together a draft document and circulate it for review.

Ted Turner Enterprises

Lu mentioned that Ted Turner is looking to potentially reintroduce swift foxes. Mike Phillips, who worked with the USFWS red wolf and gray wolf programs is now the Endangered Species Biologist for Ted Turner Enterprises. Lu said that one ranch that is owned by Turner is unsuitable for a release of foxes, a second ranch in Nebraska appears to be suitable. Lu wanted to mention the potential interest to reintroduce swift foxes on land owned by Turner Enterprises.

When the time comes, Lu mentioned that Mike Phillips will go through any SFCT/USFWS procedures. At this point, it is unclear where they stand on funding and nothing is currently planned. Lu emphasized that the best procedures/direction would come from the SFCT working with Mike Phillips.

Lu stated that he recommended that Mike investigate a research project to identify where foxes are currently and the conditions in which they thrive. Then he could initiate similar studies in areas where foxes could potentially be released to identify the habitat types and investigate the similarity to areas in which foxes are found. Lu stressed that Mike Phillips' ideas tend to be proactive rather than reactive—if the Team says "here's a need, help us to fulfill that need," Mike will likely consider the merits of the broader conservation perspective. A Team member volunteered that they are working with Phillips on a lynx and wolverine project and it has been working well since he wants to enter into an MOU with the state.

V. Habitat Criteria Committee

Julianne gave a report to the group on activities of the Habitat Committee. She mentioned that one of the priorities identified by the Conservation Assessment and Conservation Strategy document was the need to identify suitable habitat within each state. The original intent of the committee was to assist the various states in this endeavor. Julianne next described her experience in OK to undertake this task.

Using USGS land use and cover information, Julianne mapped two counties and found that it was very accurate. For example, the database delineated land use types such as cropland, herbaceous range and so forth. Julianne was able to overlay all tracking data in Cimarron County and the townships surveyed. She verified where the potential swift fox range was using the database and also used the database to identify priorities for survey work before the actual field work began. However, the database did not differentiate CRP from cropland. In OK, the CRP land is predominantly old world blue stem.

Several Team members asked about what the database will differentiate. Julianne explained that the data is useful for broad classification. A biologist can measure how many sq. km of habitat are available in the broad habitat-type categories: agricultural land (crop), herbaceous (blue grama, buffalo-grass), mixed-range (blue grama, buffalo grass with large amounts of as well, cholla cactus or sandsage), juniper and pines. Julianne furthered explained that you need to ground-truth the areas to ensure that what is depicted in the database is really out there. In her experience to date, the database is very accurate (with the exception of not being able to identify the CRP land as mentioned above). For example, if the database indicated a given area was cropland, when she went to inspect the area it was indeed cropland.

Julianne explained that the databases are available from the Internet, easy to get and are free for the entire country. To access the information, you just just need to know the name of the quadrant(s) of interest. On the USGS data page, the data are in GIRAS or CTG format; EPA has converted the information into ARCINFO coverages and can be used in ArcView. Julianne explained that in Oklahoma, OneNet, the state governmental intranet will be storing digital orthophotography that anyone can download portions. You can also overlay other data as needed. For example, the Oklahoma Natural Heritage database for rare and endangered species. California has done this as well.

Julianne has been using the USGS land use and cover database to identify survey sites and did two counties this year using the technology. To date, it has been very successful but she will continue to evaluate it and see how well it works. Julianne also mentioned that the databases were generated in 1990 from several sources of information, including high altitude aerial photography, hydrologic unit maps, federal landownership maps and state landownership maps. They have data available in some other formats and suggested that Team members check out the

site to see what is available.

The Team discussed Julianne's comments. Marsha mentioned that she expected that many datasets will be available in the next several years. Axel mentioned that he wants to examine fox census data with the GIS data. Lu suggested that Team members could take satellite images and overlay with the maps to look at specific counties and see where foxes are found compared to where they are not found.

The Team further discussed the advantage of using the GIS technology in swift fox conservation efforts. It was emphasized that it would be helpful to get state-by-state maps at the same projection level. This is needed because of the fact that presence/absence surveys may not always use the same methodologies. If the Team can use this technology, it may really be able to move the Team forward towards completing their objectives. It was recommended that the Team should look at the "big picture" and have a key person identified to look at the feasibility of developing this methodology. It was recommended that Marsha may be able to take on this role. Marsha responded that she knows it has been used to look at state/state breaks in habitat use. Marsha suggested that she would utilize GIS specialists at her facility to take the time to put this together and give recommendations to the Team.

VI. Research Committee Update

Marsha mentioned that last year she had asked Team members to provide input on potential research studies, though to date there had not been any real big funding opportunities for potential projects. John Seidel recommended that the Team encourage research that looks at the feasibility of reintroduction.

Marsha said that there was actually a lot of research being conducted by various researchers. For example, in NM there were telemetry studies and Eric Gese was in his first phase of research in southern CO. They are expecting coyote/swift fox interaction data soon and are in the writing phase now. There is also a graduate student looking at 5-6 monitoring techniques using 3 years data/field work. He is done, though his writing has been delayed since his wife is going to Africa. Marsha mentioned that Eric has a new student who will finish the monitoring analyses and plans to remove coyotes from the area, and examine changes in swift foxes distributions on the army facility there. Amy Zimmerman has finished her degree in MT and has submitted her work to the proceedings so that is ready to come out also. Kevin also mentioned that research is underway in TX and that the Team would hear more about the project later.

In summary, Marsha emphasized that the phone does ring and that Team members are very good about sharing techniques, equipment and the research as a whole has been done well. Marsha mentioned that she needs ideas from the group on additional research priorities for the Team. It was mentioned that research on reintroduction may assist with establishing a larger range for the fox. Marsha explained her research examining the viability of putting swifts where red foxes are and vice versa. Using a 10 acre pen, Marsha introduced a pair of swift foxes and allowed them to acclimate to the denning site for a week. Then, she introduced a female red fox and took 5-minute fixes on activity and location of all foxes twice daily (morning and evening). A central feeding area was used. After a week, the male red fox was introduced. A total of 6 to 7 of these tests were run. This year the same protocol was used but the species order was reversed: swifts were allowed to disperse into areas occupied by red foxes.

The data are fuzzy from the first year, and stronger the second year (reds in pen first, then introduced swifts). She found that the red foxes were not putting up with the swifts: if the swifts tried to use the dens, the reds stomped on the ground when the swifts were in the den and urinated all around the pen. No foxes were ever injured, though there was plenty of vocalizing. The reds don't attack the swifts, but don't necessarily put up with them. There are also seasonal trends in the data. In the spring, the reds are more territorial and more aggressive. As the study

progressed into the fall, the relationship breaks down a little. The swifts stayed under the observation tower--and watched the reds doing their thing, though they were definitely threatened.

Marsha explained that the 10 acres is a set pen size since she is using pens that were built previously. These pens were used to look at red and arctic foxes using the same methodology she is currently using. She feels that this is a good experiment and gives insight into the dynamics between the species without the cost. Marsha mentioned that as of the end of this year, she will be out of the swift fox business; she will be surplusing those that she currently has.

Axel asked Marsha about the effect of the food source: could there be a difference in findings when using a limited or a dispersed food source? Marsha suggested that she has found that with reds, they are generally non-confrontational anyway and that their bark is bigger than their bite. She hypothesized that the food source might make a difference but that the seasonality data dispute that given the waning of aggressiveness as the season progresses.

Axel volunteered some information he has read. In confrontations between arctic and red foxes, the arctics kick the reds out of den. He did observe reds and swifts laying together--he observed that in this case, the red didn't seem to care while the swift was alert but didn't do anything. Another time, he was following an uncollared swift and then one day, there was a family of reds instead of the swifts he had been following. In another case, he observed a single male swift fox bark and look at reds rather than go into the den.

Marsha recited an observation during the first test situation where 2 reds circled and chased the female swift, keeping her at bay. At first, Marsha didn't know if the animal was dead or not. They found that the swift was fine but noticed that it definitely stayed near the researchers rather then venture out into the pen.

A Team member asked if hybridization has been known to occur between red and swift foxes. Lu mentioned that there was one report in the literature where hybridization was reported.

The discussions next turned to the distribution of red foxes. It was suggested that red foxes are found where there aren't coyotes (canid hierarchy). In ND, human activities seem to dictate the relationship of canid communities, for example the fur prices and what is going on with people in general, though diseases such as mange may also play a role. A Team member volunteered that in eastern NM cropland areas, there are probably coyotes and appear to be both red and swift foxes so asked if there is a density of coyotes or people that will limit red or swift foxes? Marsha stressed that it is not the density of humans that is important, it is what people do. Axel mentioned that there seems to be a balance between coyotes and reds, some coyotes are needed. In a situation where coyotes are knocked out, that is probably the worst for swift fox. Also, coyotes and golden eagles have a similar prey base in summer--the eagles tend to settle in places where coyotes don't settle. Therefore there may be an inverse relationship between coyotes and eagles population numbers.

In sum, the Team agreed that additional research is needed to determine the dynamics of inter-specific relationships that affect swift foxes. Marsha asked the group to give the committee research ideas as well as any ideas on potential funding sources.

VII. Update on Symposium Proceedings

Lu and Marsha are in the process of putting the symposium proceedings together. Lu emphasized that the final product will be comparable to the wolf symposium proceedings and will use the same format, as well as hopefully serving the same purpose (to stimulate discussion and attention on the species). Lu mentioned that in addition to papers presented at the meeting in Canada, the editors have solicited additional chapters where needed. The process of putting the

document together is a lengthy one and includes seven stages: 1) initial document draft submitted; 2) first review by proceedings editors; 3) editorial review by peers in the field; 4) resubmission to author for re-write if needed; 5) 2nd editorial review by peers; 6) final author re-writes; and 7) document submission or rejection. Additionally, once the document is accepted, it is forwarded to a copy editor who makes formatting edits. All accepted and reviewed documents are submitted to the publisher as a unit for publication.

Lu and Marsha hope to have the proceedings wrapped up by 1999 and in publication by late 1999 or early 2000. They stressed the use of illustrative material including photographs, figures and tables. The audience is varied and includes scientific professionals, the general public, and the conservation community at large. The book will not be strictly the proceedings of the conference.

Currently, $12,000 is in place to fund the publication of the proceedings. However, additional funds are needed and the editors will solicit those funds. The editors may charge page fees as well. In sum, Lu mentioned that the publisher has been chosen and progress towards publication is well underway.

On a related subject, Marsha mentioned the status of the annotated bibliography project. It is currently being hosted on the Northern Prairie Research Center's homepage and can be reached through that web site (http://www.npwrc.usgs.org). Marsha thinks the site is impressive and since it's interactive it can be added to and is for the benefit of Team members.

VIII. Update on the Swift Fox in Canada

Lu mentioned that Steve Brechtell, Chairman of the Recovery Effort in Canada sends his regrets to the Team that he couldn't make the meeting. Lu emphasized the cooperative nature of the swift fox program--conservation doesn't end with borders. For some background, the swift fox historically reached the northern edge of the southern provinces such as Alberta, though environmental conditions are different across the species' range. The fox disappeared in the 1930s and was first reintroduced in 1983. Initially, foxes were soft released from pens in the prairie, though this method had high labor costs. A total of 140 foxes were released from 1983-1987. After 1987, biologists used a hard release method using foxes from captive facilities such as Cochrane, Moosejaw, and the Calgary Zoo. In total, the biologists have released a large number of foxes (over 900), more individual animals than any other program. Currently, an estimated 300 foxes are in the prairie region. This established population indicates that the ecological niche is still there. Biologists are 95% confident that there are approximately 179-412 foxes in the core area (54% of total range) from census reports in 1996-1997.

In an effort to determine how many foxes were out there, biologists set 6 traps at 1 km intervals, tagged and released animals and then measured the number of marked foxes compared to unmarked ones. Over 1000 trap nights, there was a 4.9% per trap night success rate. In addition, Axel's study is now in place, though it is difficult to get authorities to put money on the table for research. This does work in cycles though—when the research is in place and authorities see the numbers of foxes that are out there, they are happy with the results of the research.

After 15 years of releases, the recovery team is still in place though efforts have curtailed. Further efforts will include supporting Axel's work in the field as well as a new student. Also, there is a need to need to look at the potential for a Population and Habitat Viability Analysis (PHVA) as well as a closer look at the success of translocated versus captive-raised foxes. Biologists also need to conduct food habits studies, studies on the adaptations of the foxes to northern conditions, den use and inter-specific interactions (e.g. ground squirrels, badgers, red foxes). There have not been any releases this past year though there is a census in place to pick up changes in population numbers. In addition, there will be a major census five years from now.

The discussion next turned to the effects of the Cochrane/Defenders of Wildlife-sponsored

releases and the effect on the Canadian recovery effort. Axel stressed that it is important for the Canadian effort that they have knowledge of where the foxes are and how many there are and that releases close to some of the Canadian reintroduction efforts will be counter productive in the experimental design. Lu agreed. Axel also had concerns about the reintroductions since they are being done without being carried out with a review by the Canadian Swift Fox Recovery Team and the American SFCT. The Team discussed the Cochrane Wildlife Institute's motivation for releasing animals. It was mentioned that they see the world from their own perspective and feel that they do have a mission and are very passionate about what they do. However, there is a general disregard for processes and not much thought as to the general effect of what they are doing. Since so little is known about their program, neither the Canadian Swift Fox Recovery Team nor the American SFCT is in a position to coordinate projects. It was stressed that this was not necessarily intentional, just that they were not aware of what is going on.

IX. Update on Standard Monitoring Techniques

Marsha suggested to the Team that there are quite a few different methodologies being used to monitor foxes and that they ranged in the amount of labor required. Currently, there is not a consensus on what methodology all states should use to monitor foxes. She suggested that the group compile a listing of what will work and that by providing the information from several pivotal studies, the group can digest the findings and make some decisions on preferred methodologies. Some examples of studies that are out there, or are due out soon, are the Fred and Scott Travis paper as well as Christiane's township data.

Marsha pointed out that states need distribution data--where foxes are found and where they aren't found. In addition, ideally it would be useful to know how well the population is doing. The value of research studies is you get a better look at how productive the populations are, their reproductive success and mortality rates. If little data on your population are obtained, you learn very little about reproduction of the population. To date, not all states employ the same monitoring strategies or research projects because of funding issues. At the very least, the Team hopes to come up with minimums.

Marsha also mentioned that the research statistical center is available for use at the Northern Prairie Center. This service is open to anyone on the Team who wants assistance.

The discussion turned to how to determine what is the Team's recommendation for the best broad-scale monitoring method? It was suggested that the best methods, though very labor intensive are saturated trap/mark recapture studies. Axel suggested that the best monitoring method may depend on the density of different canids in the area. It was volunteered that there are data available on swift fox/red fox foot sizes (55 vs. 34-36 respectively). In Texas, gray foxes are another species that the biologists have to worry about when using track plates. It was stressed that each method has its own pros and cons; what works in one area may not work in another.

For example, in Texas, Kevin has been combining spotlighting with track plates. Conversely, KS biologists have found that spotlighting is not effective. In the townships, presence/absence data can tell a lot over the long-term and given indications of trends in the populations. However, detection probabilities do depend on the size of the plates, transects etc. Cameras were suggested as a viable monitoring method, though it was mentioned that while they work, they can also be stolen. In KS, the survey area is monitored in three year rotations and only a portion of the entire study area is covered each year.

The work of Gese suggested that methodologies may have to change depending on season. He found that using scent posts were better for him, but then in spring the density of the population changes and by the fall, he must switch to presence or absence because the density is so low that

is the more effective method.

Marsha stressed that what is needed to compare all the methodologies is money and time. She mentioned that a checksheet comparing the pros and cons of each method would be do-able but she would need help doing it. She also emphasized that in the end, the Team will probably not come up with one single method since the situations vary so much across the states.

X. Prairie Dog Petition Status

During lunch, Pete provided the group with information on the prairie dog situation. The emergency listing proposal of the black-tailed prairie petition was not accepted, the species is too numerous to face extinction in the short term. There will be a 90-day finding however to decide whether to conduct a full review or not. Pete stressed that he has not seen a subject with as many different opinions and mis-information surrounding it. He also mentioned that this case is different from the classic case where typically you are looking at a species that is few in number. The prairie dog is a colonial species, has significant disease problems and is also persecuted.

The next step is a 90-day finding that will indicate whether the USFWS will conduct a 9-moth comprehensive status review. If the USFWS eventually goes forward with listing, it may be on a warranted but precluded status. Or, the case may go further to listing without the precluded status.

Population trends in prairie dogs are showing some declines. For example, the population in MT has declined by 50% in the last decade, and in Mexico the population has also declined by 50% in the suitable habitat areas in the last decade. In general, there are a few colonies that have 1/3 of all prairie dogs, and then some small colonies that comprise the other 2/3 of the population with few mid-sized colonies in between.

Pete mentioned that this is the first petition that the National Wildlife Federation has ever filed and he feels that they are in it for the long term. He suspected USFWS will have a big job ahead of them. Pete feels that there is a real opportunity to manage prairie dogs on public lands. He stated that if there ever was a species that was going down hill but was still manageable, this is it. The manageable threats are recreational shooting and poisoning. Populations seem to be resilient in the absence of disease in South Dakota. Plague is still moving through the populations however and this is the threat that we can do the least about. If plague gets into SD, it could cause some real damage.

XI. Axel's Presentation on Swift Fox Research and the IUCN Canid Specialist Group

Axel began by outlining some of his recent activities as follows:

I. Develop causal hypotheses for assessing coyote intra-guild killing of swift foxes and kit foxes in North America

II. Handling of swift foxes and coyotes; determination of factors affecting the likelihood of trapping and developing new methods of trapping

III. Determination of mortality causes using comparative techniques (field and pathological data)

IV. Examination of reproductive parameters by examining reproductive status of females in the field

V. Determining presence of endo-and ecto-parasites

VI. Examination of inter-specific niche overlap between coyotes, swift foxes and red foxes

Axel then went into more detail on select aspects of his research.

I. Study examining the effects of small scale habitat fragmentation

This study assessed the impacts of pipeline construction on swift fox movements, den use and survival. Results from this study are important to the fox's welfare and population stability. For example, if there is a conflict between industry and the local human populations, the end result will be bad for the fox.

The pipeline project is a $1billion project linking the Alberta oil fields to WY refineries. The pipeline was originally monitored for indigenous species, however the swift fox was not originally one of those species. Axel then trapped 13 foxes on the pipeline corridor and monitored them during both prior to and following construction. Of the 13 foxes, 9 either died or left the study area. Axel studied the remaining individuals to examine the effect of the construction and determine mitigation measures. The results are as follows. Examining fox movements 6 mos. before and 6 months after construction, Axel found that the foxes were moving away from pipeline. However, using control animals as well, Axel drew in hypothetical pipelines on his tracking data and found that these control foxes also moved farther away than before. Axel realized that the pre-construction time-frame had fewer winter months than the post-construction time frame so foxes were actually just moving farther in the winter months. What he was seeing were simply seasonal movement effects.

When he examined den use, he found that dens were actually closer to the pipeline after construction than before so the foxes were not being forced away. In sum, Axel concluded that the pipeline did not necessarily displace the swift foxes.

2. Examination of the effectiveness of translocations to re-establish swift fox populations Twenty-eight foxes were translocated and 48 control animals were collared. Data showed no large differences in survival rates between wild-born forxes and translocated animals. Between years, the WY foxes tended to do better. Results indicate that translocations are effective and that wild-born translocated individuals do better than captive-bred foxes; statistical analyses of these trends are currently being conducted. However, they have never attempted a soft release of wild-born translocated animals (all WY animals were translocated and then hard released). To date, there has not been good pre-release training of captive-bred foxes. These data are similar to those found in other reintroduction programs.

Axel then discussed the background of the IUCN Canid Specialist Group and an update on their activities. The Specialist Group was formed in 1981 and includes representation of biologists from all over the world. Publications include the recent African wild dog and Ethiopian wolf Action Plans, an upcoming Arctic Fox Action Plan and one for the swift/kit fox which Axel will be writing.

Axel explained that regardless of the taxonomic debate, kit and swift foxes face the same threats, predominantly agricultural development. What will differ between the two species is the way that recommended conservation actions are implemented. For example, a rich educated land owner in Canada will have different needs than a poor Mexican farmer. Regional approaches to swift and kit fox conservation need to be considered. There are five different regions for kit and swift foxes: Canada, US., San Joaquin kit fox, non-San Joaquin kit fox and Mexican kit foxes. The Action Plan will provide a synthesis of the information out there, look at common problems as well as local, unique situations. Axel predicts that the plan itself (the document) will help with fund-raising and awareness as well as provide international recognition.

Axel outlined the Swift/Kit fox Action Plan timeline. He hopes to begin late spring or early summer. Initial funding has been obtained for the document and the chapter topics have not been set yet. He is looking for cooperation from the team and also for topic areas such as reintroduction, disease etc. Axel also mentioned that by 2001 the entire canid action plan will be re-written by the Specialist Group.

The discussion then turned to the current status of the Canid Specialist Group. The Group is based at Oxford and to date all work has been running through there. This has become too overwhelming so the group has been split into smaller subgroups now and regional working parties grouped thematically and by species: Africa wild dog, Ethiopian wolf, arctic fox, dhole

and a swift fox/kit fox group. Axel is the coordinator of the swift/kit fox working party. Membership to the group is open, in the sense that members have to be involved in the conservation of swift fox and work towards that end when needed. Axel hopes that the Canid Specialist Group can work together with the swift and kit fox groups and continue to bridge the gap between researchers and biologists.

An issue facing the foxes currently in Canada (particularly Saskatchewan) where half of the population can be found is that 1080 has been allowed again. Axel emphasized that this is a huge step backwards and a case where agricultural interests have overruled wildlife agencies. As it stands now, a rancher can call and say that they want 1080—a conservation officer then surveys the land. If no swift foxes are found, 1080 may be legally used. The word is that conservation officers don't want to undertake this task either because the areas are so large and monitoring the presence or absence of foxes will be difficult to do, though a critical part of the process. Axel noted that the swift fox is still on the endangered species act in Canada.

Axel asked the group for any comments and any knowledge of the effects of 1080. He stressed that he is supportive of alternative ways to deal with coyotes. Lu mentioned that this is a very political situation since it is only targeted in areas where there are sheep. In essence, a very small, but very politically-connected group of sheep owners are pushing this issue very hard.

The Team suggested additional alternatives such as ensuring that the 1080 efforts are more target specific (e.g. put chicken heads poisoned with 1080 in those areas where there is a definite problem—not cover a whole township, or trying poison collars on sheep). Marsha mentioned that there had been previous discussions with USFWS about the fact that M44 baits could be pulled by swift foxes easily.

XII. Collection of Samples for DNA and Disease Analyses

Christiane mentioned the draft document that she and Marsha had been developing to create a centralized, standardized sample collection and testing protocol that could be used by all biologists working with swift foxes. Historically, nearly all Team members as well as some students have been collecting samples when the opportunity arose. Axel has also taken tissues as well using AZA protocols (Dr. Linda Munson). In addition, Beth Williams has performed some of the analyses. Several team members mentioned that they currently have samples that they just need to send somewhere for analysis.

The Team agreed that a centralized repository and testing center was needed and that they were almost there on protocol issues. It was recommended that perhaps Beth could serve as a clearinghouse for samples. It was also mentioned that Bob Wayne could be approached to conduct some of the work, however it was stressed that he would more than likely need both funding as well as a student to complete the work. Lu emphasized that the Team establish a databank (for blood/hair etc.) using a reputable individual or institution so that the information could be retrieved at a later date if needed for retrospective analyses. Gregg Schmitt volunteered that for genetic analyses, the University of New Mexico has maintained a significant collection of mammals for over 15 years. He stressed that universities are actively collecting tissues for analyses and that Jerry Dragoo at UNM is doing genetic work from tissue and actively trying to collect additional specimens. He said that the agency in NM is particularly interested in the hybrid zone between TX and NM. Gregg doesn't have anything to report now, but the green light has been turned on. He anticipates that by the late spring of 1999, Jerry will have microsatellite data and be able to compare swifts to kits. He mentioned that additional Team members could provide samples. Tissues from dead animals can be valuable as well once they are preserved. Gregg will talk with Dragoo and see where the blanks are in the dataset. Jerry and Christiane can work together to see what the needs are and what additional samples the Team can provide. Christiane and Marsha also mentioned that they would like to know the relatedness of their foxes.

The discussion returned to Wayne's work which several Team members mentioned was limited by the geographic origin of the samples. Lu stressed that while Wayne is looking at taxonomy, there is still a need for a national institute for the preservation of tissues and a centralized database. Gregg mentioned that the UNM collection is there for perpetuity, is well-funded and not individually based. Furthermore, museums share tissues on regular basis. In the case of UNM, the objective is to build a thorough southwestern collection. Additional comments included checking out the forensic lab in Oregon and Dr. Steve Fain who assisted with the Mexican wolf specimens.

Christiane and Marsha will continue to work on the standard collection protocols, disease and genetic-related research projects and identifying potential repository sites. These will be available in the next annual report. Beth Williams will also be approached to see if she is willing to accept samples and/or serve as a clearinghouse for samples. Lu mentioned that she has historically been interested in canids and gets work done. The group agreed and will also add her to the list of interested parties. The Team also agreed that samples are needed at every opportunity to make the most of the available resources and provide an opportunity for future analyses. The group also agreed that enough blood could be taken opportunistically from individuals to examine both genetic and disease issues (Lu pointed out that in many cases disease is probably less of a concern than taxonomy).

XIII. Formalizing the Conservation Assessment and Conservation Strategy (CACS) Document

The Team discussed the need for a formally signed agreement related to the CACS. Such a document would outline what various parties agree to do. An example agreement using the grouse was circulated that utilized candidate conservation agreements. There was discussion that the track record on these types of documents in courts is not good at all, especially if there are no regulatory abilities; what counts are results, not promises.

Pete suggested that an agreement between the states would be a good idea. He mentioned that even if the Team thinks everything is in good shape now, additional work still needs to be done. An agreement that would stress continued commitment to the species would be a wise thing to consider.

The group questioned the need for a formalized document beyond the CACS. They mentioned that the CACS was initially developed using a recovery plan as the basis for the conservation agreement and that in many ways it is a recovery plan for all intents and purposes. Several members mentioned though that if the status of the swift fox is challenged again, there should already be a formalized agreement in place. Eileen mentioned that was the purpose of the state commissioner's letters.

Several members asked what the components of a formalized document would be. It was suggested that the document recognize that the swift fox's status is tenuous and that intentions are to continue to meet, work and monitor the species. It was stressed that in the future, if problems arise, the first thing that will be brought up is that "states dropped the ball." That could be resolved with a formalized agreement. If the Team continues to produce information, an annual report, have regular meetings—that will make it easier for USFWS when the issue arises again.

Pete mentioned that the swift fox may not be at the brink of extinction, though it still may be in trouble. Dave echoed Pete's comments and stressed that closure will be difficult. Dave said that politics and species biology will determine the closure, not the Team. Eileen suggested that in the future the Team may be able to go to 5 year intensive counts. There is enough work in the

CACS to keep moving forward, assuming the money and staff are there to conduct the work.

The group discussed concerns over how they could use the grouse document as a model for a formalized swift fox document. Christiane said that it was difficult to formalize these steps since the 5 threats that are addressed in the grouse document are not applicable. Dave mentioned that the CACS is supposed to be a working/living document and that it could be changed as needed and changed as the Team's goals change. Eileen suggested that "formalization" is a difficult term and puts people's feet to the fire a little. Pete suggested that if the fox does not get listed, the states should remain involved with swift fox conservation. Then if the listing issue comes up again, the states and feds will need to demonstrate that they can work together effectively. Dave mentioned again that the CACS is a working document and is meant to be flexible.

John mentioned that in CO, they need future commitments. They have a minimum of 5 years before they can have any sort of fee increases and there is a lot of pressure to spend money on mule deer and rainbow trout. John said that there have been major changes in operations and that he had to drive to this meeting because of a lack of money. The Team mentioned that the threat of a listing worked to keep states involved.

Pete asked if anyone on the Team was familiar with a situation where there was a species that was designated warranted for listing and then removed from the candidate list. Greg volunteered the experience with AZ and NM on jaguars. In the 11th hour, to avoid listing (which was imminent anyway) federal/state agreements were established. That helped with commitments as well as monies.

Pete and Dave suggested that states consider sending a letter to the Service when (if) the swift fox is removed from the candidate list stating that the state fish and wildlife agencies will remain committed to implementation of the Swift Fox Conservation Strategy. This could be a letter only or a more formalized conservation agreement--the form isn't as important. What is important is that states demonstrate that they will continue, to the best of their ability, to monitor fox status. Dave mentioned that he will check into what a conservation agreement is and look for other examples. Pete suggested that the time to compose these agreements is now.

Eileen recommended that the group table this discussion for now since the attendees were not clear on where to go with the issue. She also suggested that since he originally brought up the issue, Brian will get back to the Team on possible suggestions for formats, overall goals, commitments by states and the federal agencies.

XIV. Summary of Individual Team Member Commitments and Assignments
Eileen suggested that per the Team's bylaws, a new chair and co-chair needed to be elected. Steve and Eileen thought that northern states have been over-represented so maybe the Team could look for representation from the southern states.

The Team nominated Julianne as the new Chair and Christiane as the Co-Chair. Both accepted the nominations. Additionally, both Julianne and Christiane were nominated as annual report editors, Brian will assist.

The Team also discussed the location of the 1999 Annual Team Meeting. Eileen and several other team members mentioned some of the issues that were encountered this year, including costs and location. It was agreed that these issues be kept in mind when planning the next meeting. The group discussed whether the meeting should be over a weekend for cheaper fares, or connected to another meeting that many members would be attending anyway. Potential meeting locations that were recommended included Bismarck, North Dakota, Kansas or Denver. It was mentioned that the Team could take a field trip if the meeting was in North or South Dakota. Also recommended was a meeting preceding the Wildlife Society Meetings (Austin,

TX). It was also suggested that to be fair, maybe the Team could consider hosting the meeting at a location where there could be a field trip one year, followed by a meeting at an airport hub the second year. The Team agreed that Kansas would be a good option for this upcoming year. Therefore the Team agreed that KS would be the site of the 1999 Team Meeting the first to second week in December.

Given the fact that Christiane will have so many responsibilities with the annual meeting as well as committee responsibilities, the group recommended that Kevin assume the Co-Chair position instead. Kevin agreed though mentioned that he may not be in the same position with TX Parks and Wildlife in several months. The group understood and agreed that if he was not available, the position would be transferred to Christiane.

Eileen asked if there needed to be any changes to the current committees (habitat, education/information, research). Julianne, Kevin, Brian, John and Axel are willing to serve on the Habitat Committee. Julianne and Marsha will look into data needed and services available for the MIPS/ARC INFO/ARC VIEW datasets, the University of Oklahoma services and the Northern Prairie Wildlife Research Center resources as well.

Marsha stressed that she needed guidance from the Team for the Research Committee. The Committee will continue to provide guidance and direction for Team members on specific projects. Axel suggested that he can connect with kit fox groups for any additional resources. Marsha will also compile an evaluation of monitoring techniques that will include a side by side comparison of each technique and what can be expected from each. She will present this to select members of the group for comment first and then to all group members for comments. Pete stressed that this effort was critical to the next phase of the recovery effort. Marsha mentioned that she would need some funds to complete the study if it is done independently, though there are some data out there already (Gese and his students) that can be presented as a package.

Lu suggested that he will go to Julianne if anything develops with Ted Turner. Eileen recommended that Frank is the contact from the Education Committee to work with Tarren regarding captive conservation and research efforts.

Eileen asked if there is a need for the Team to integrate with other groups since many share the same problems that the Team is dealing with. Pete stressed that while it is a worthwhile goal, it is very difficult to do. The Team agreed that maybe a compromise was to ensure that both the Chair and Co-Chair are aware of other related groups and who the point people are.

Eileen mentioned that the annual report is due by the end of January. Team members need to get their information to Christiane by the end of January.

Lu mentioned that Steve Brechtel in Canada asked him to mention that they will be conducting a winter survey on the Montana border if Americans want to piggy back onto that program, there is an opportunity to do so. Some funding is available.

Lu also mentioned that as a result of the symposium, he is also compiling a database of research projects conducted with swift fox in North America to date. He needs submissions of research projects and is looking for information such as the duration of the project, number of collared foxes etc. Lu will draft a questionnaire and Marsha will accept completed questionnaires.

Eileen will be the contact for the reintroduction guidelines and needs the IUCN guidelines. The Team would like to have a draft completed by the end of September. It was recommended that the minutes include the fox status and census information from Canada.

XV. Information on the Field Trip and Texas Research

Kevin discussed the project in TX that the Team visited the day after the meeting. There are two sites in the study, one is private rangeland, the other is on national grassland property. The private land is a large tract of land surrounded by CRP/cropland, 11 foxes have been collared and 3 have been killed to date by coyotes. The national grassland property is also a large tract of land and 15 foxes have been collared, 3 have been killed to date by coyotes. The density of foxes is higher on private lands and foxes are more spread out on the grasslands.

This is a coyote/fox interaction study, coyotes are being collared on both sites. During the first year, both areas will be studied as is. During year 2, coyotes will be removed from one site (the one with the largest coyote population) and the effect on the foxes will be studied. This will not be a one-time removal, coyotes will be kept out the entire year. The biologists will be studying spatial differences between the species, food habits and competition for prey. Additionally, blood is taken from both the coyotes and fox.

The two sites are very different, one is short grass prairie and the other is interspersed with agriculture. This study will allow biologists to get fox survival rates, mortality rates, land use patterns and determine if coyotes are more of an impact in the different land types.

Kevin said that the private land owner they are working with is very helpful and that he approached him and said that he had a lot of foxes and wanted to know what he was doing right. Kevin contrasted this with a private landowner who mentioned that he saw a swift fox in a prairie chicken survey and now refuses to work with him. Axel mentioned that it may be helpful to document the number of escape trails/holes that are in each study area. If a fox is being chased, how far can they make it before they have to go down a hole?

Appendix I
1998 Swift Fox Conservation Team Annual Meeting Attendees

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Appendix II
Swift Fox Captive Conservation Program

Focus

The Swift Fox Conservation Team and AZA Canid TAG have endorsed the Fort Worth Zoo to spearhead the development of a cooperative captive conservation program for the swift fox. The objectives of this program are threefold: 1) to assist in the development of a nationwide conservation awareness and education program; 2) to support Swift Fox Conservation Team field efforts; and 3) to maintain a healthy, genetically-viable captive population.

Activities

Conservation Education

- Development of a two-sided full-color brochure and poster highlighting the swift fox, its conservation status, ecological role and the prairie habitat. The poster will also provide post-sighting contact information and add to the database of the current status and distribution of the fox.
- Development of swift fox fact sheets and teacher resource manual
- Integration of swift fox information into Canid TAG and North American Conservation Action Partnership web sites
- Development of swift fox art and T-shirt for educational and fund-raising efforts
- Partial support of biologist Axel Moehrenschlager to annual Team meeting.

Field Conservation

- Purchase and loan of handheld GPS to TX Team member to assist in the location and marking of den sites
- Development of restricted list serve for the Conservation Team
- Collection of developmental data to assist field biologists with aging kits
- Submission of several conservation research grants on behalf of the Team
- Establishment of swift fox conservation program account

Research/Development of Technology

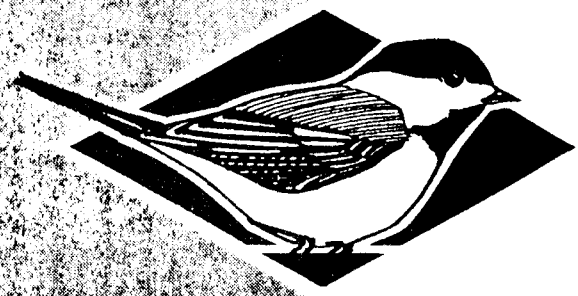
- Investigation of multi-institutional swift fox reproductive biology study with biologist Dr. Cheri Asa
- Investigation of effective contraceptive implants
- Purchase and loan of den probe to Texas Team member

Captive Programs and Exhibition

- Named as a priority small-canid species on the Canid TAG Regional Collection Plan
- Petition for AZA Swift Fox Regional Studbook in progress
- Eleven zoos in the U.S. and Canada have received swift foxes and/or participate in this program (Fort Worth Zoo, TX; Houston Zoo, TX; Bramble Park Zoo, SD; The Living Desert, CA; Great Plains Zoo and Museum, SD; Sunset Zoo, KS; Wild Canid Survival and Research Center, MO; Lee Richardson Zoo, KS; Dakota Zoo, ND; Kamloops Wildlife Park, BC, Canada; Valley Zoo, Alberta, Canada). Five additional zoos can come on-line in the next several years.
- Swift Fox Captive Conservation Program Organizational Meeting held at AZA National Conference (September 1998)
- Presentation at AZA National Conference entitled The Swift Fox Conservation Strategy: Field- and Zoo-Based Efforts

Appendix III
Population Census of Swift Fox (Vulpes velox) in Canada: Winter 1996-1997

Executive Summary



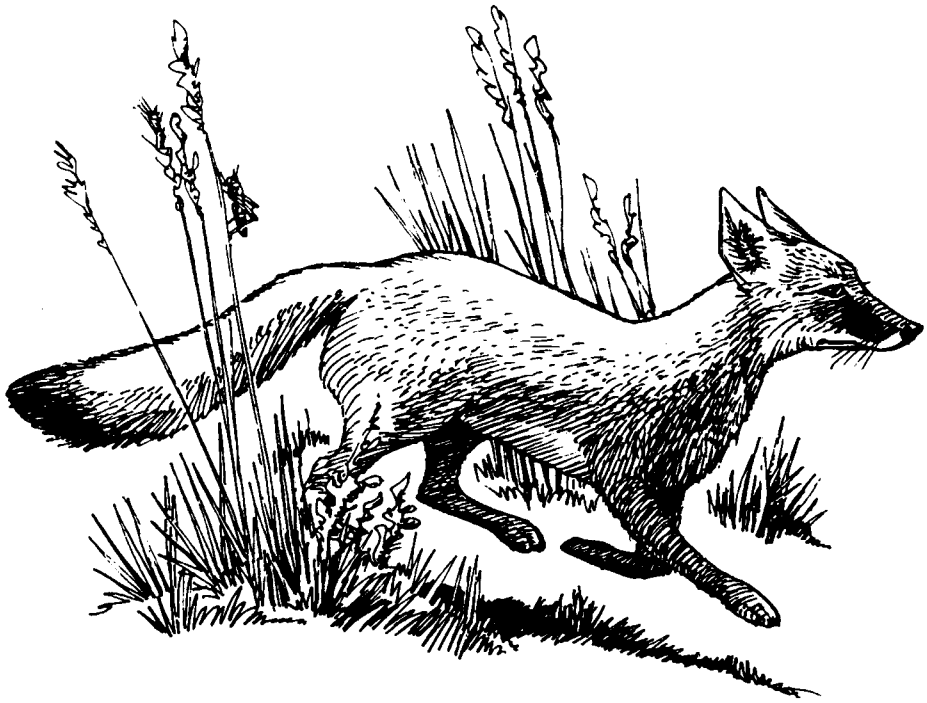
Wildlife Management Division

STATUS AND SURVEYS BRANCH

Alberta
ENVIRONMENTAL PROTECTION

Population Census of Swift Fox (Vulpes velox) in Canada: Winter 1996-1997

by S.E. Cotterill
for
THE SWIFT FOX NATIONAL RECOVERY TEAM



April 1997

Executive Summary

The Canadian swift fox population was censused during the winter of 1996-1997, throughout its suspected range in south-eastern Alberta and south-western Saskatchewan. A calibration-based census technique was designed in order to circumvent logistical constraints associated with winter fox trapping, and limitations associated with the assumptions of a mark-recapture census method. The calibration-based method used current Canadian swift fox home range data to determine: 1) the area sampled by a series of six live-traps set one kilometer apart (67.1 km^2); and 2) a trapping success correction factor based on the success of the census method in capturing marked swift foxes within known home ranges. This correction factor was used to adjust and interpret trapping results throughout the census area.

Fifty-eight townships were surveyed during the census, representing 54% of the suspected swift fox range in Canada. Six box traps were each placed one kilometer apart along a trap line within each surveyed township. Fifty-six of the townships were surveyed for three nights, while two townships were censused for two nights, resulting in a sampling effort of 1,032 trap nights. Thirty-two individual foxes were trapped during the census, and a total 51 captures, including recaptures, were recorded. The overall trapping success was 4.9% per trap night, and 3.1% per trap night for unique captures. Four of 14 calibration foxes were trapped, resulting in a correction factor of 3.5. Therefore, every fox captured represented 3.5 foxes in the area surveyed.

The Canadian swift fox population is estimated to be 289 foxes (95% confidence interval: 179-412 foxes). The Alberta/Saskatchewan border population is estimated to be 192 foxes (95% confidence interval: 93-346 foxes). The swift fox population in the Wood Mountain area is estimated to be 87 foxes. A reliable confidence interval could not be obtained for the Wood Mountain region due to the small sample size.

Of particular interest is the fact that more than 80% of the foxes captured were born on the Canadian prairie. Released foxes have survived and reproduced, and their offspring form the core of the fledgling Canadian population.

This new census technique has the potential to either slightly overestimate or underestimate the population size. However, it does provide a much more reliable and accurate estimate of the Canadian swift fox population than previous survey methods. It also provides a solid baseline against which to measure future population trends.

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